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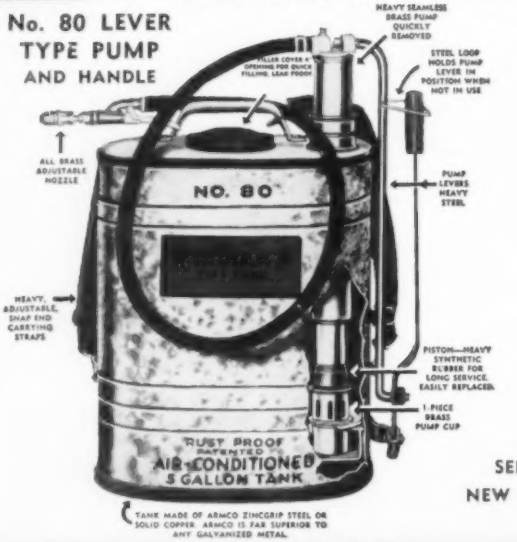
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Photo courtesy U. S. Forest Service.

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Fifty Years of White Pine Blister Rust in the Northeast

Ray R. Hirt
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A HALF-CENTURY ago white pine blister rust, now one of the most serious fungous diseases of our native coniferous forests, was introduced into northeastern North America from Europe.

White pine has been an important factor in the economy of the Northeast since the time of the earliest colonial settlements. The wood was used for such a variety of purposes and in such quantity that by 1900 many of the fine stands were seriously depleted of good commercial timber, and reforestation with white pine seedlings had begun. Because the demand for seedlings exceeded the supply from American sources, planting stock was imported from European tree nurseries regardless of the fact that blister rust was widely distributed in European forests and known to be present in certain nurseries. As early as the mid-Nineteenth Century the disease had been recognized in Europe as a hazard to 5-needle soft pines, including eastern white pine.

The late Dr. C. A. Schenk, as early as 1898, had warned against importing white pine nursery stock into America from Germany because of the danger of introducing rust-infected pines. He predicted disaster to native 5-needle pines if the pathogen became established in North America.

Nevertheless, seedling stock continued to be brought into the eastern United States and Canada by some private and state agencies until importation was prohibited by law under the federal Plant Quarantine Act of 1912. By then many million two and three-year-old white pines had been shipped from Germany and France to the eastern states and Canada. At least as early as 1908 some of the

FIG. 1.—A blister rust canker on the trunks of a young white pine.

FIG. 2.—A white pine killed by blister rust.

shipments included rust-infected pines that were planted in the Northeast, New York, and Pennsylvania.

In the autumn of 1906, the blister rust fungus, *Cronartium ribicola* Fischer, was present on ribes leaves growing on the experiment station grounds at Geneva, New York. This suggests that in the spring, somewhere not too distant, aeciospores had been produced on one or more infected young pines. By early summer 1909, the disease was found in the Northeast for the first time on young eastern white pine, *Pinus strobus* L. Although state officials, upon discovery of the disease in America, seriously tried to trace and destroy infected transplant stock, it was impossible to locate all the diseased plants. Blister rust of 5-needle pines was even then beyond the point of eradication.

Dr. Perley Spaulding in 1911 pointed out that when the blister rust fungus became established in America it would remain a permanent adverse factor in the cultivation of 5-needle white pines, and might be more virulent than on the Asiatic and European tree hosts. Time has proven the accuracy of this prophecy.

Early Attempts at Control

New York had received and planted more pine stock from Europe than any of the other eastern states. When infected pines were found in the state in 1909, the Forest, Fish and Game Commissioner, J. S. Whipple, immediately called a conference in Albany of northeastern foresters, state, and federal officials to consider the serious problem of eradicating the rust pathogen.

New York was perhaps one of the first states in America to attempt eradication of the fungus through the destruction of infected ribes. Eradication of ribes near valuable pine had begun in 1908. At that time no one knew with certainty that the fungus could spread from infected pines to ribes plants many miles distant, and that within a single favorable season a few infected pines could be the source of widespread ribes infection, resulting in newly infected pines near these infected ribes.

FIG. 3.—Ribes eradicating crew using hand tools.

In 1915 a serious outbreak of infection on white pine was discovered in western Massachusetts. The following year an emergency fund of $15,000 was authorized by the Governor of New York for blister rust control through ribes eradication. The state employed 35 men to create an "immune" zone 2 miles wide along the Massachusetts border by eliminating wild currant and gooseberry bushes, for the purpose of slowing up or stopping the western spread of the rust.

A National Problem

Meanwhile, the Massachusetts Forestry Association concluded that blister rust of white pine was a national problem. The presence of blister rust in the Northeast was a threat to all our native 5-needle pine forests of the South, the Lake States, and the far West. To achieve control, coordinated effort of the federal government, many states, municipalities, and private individuals might be required. Planning, leadership, and financial aid on a national scale seemed to be justified. A conference was called in the fall of 1915 and the Interstate Committee for Suppression of the Pine Blister Rust was organized. Through action of the committee, Congress was asked for $50,000 to fight the disease. The sum was made available and a survey was begun to determine the extent of the infection.

In November 1916, the committee was reorganized and the name changed to the Committee for the Suppression of Pine Blister in North America, later reorganized as the American Plant Pest Committee. That same year Samuel B. Detwiler, forest inspector of the Bureau of Plant Industry, in his report on the distribution of the rust, applied the term "general infection" to localized areas of the Northeast, and seemed to sense that, in the eastern pine growing regions, efforts should be directed toward control and not dissipated in the hopeless task of eliminating the fungus pest.

In New York, thought was directed toward the policy of planting white pine in "control" zones, areas where complete eradication of currants and gooseberries, wild and cultivated, could be accomplished within and around the areas to be protected. An important conclusion was reached during consideration of this policy, namely, that planting should be defered until investigations disclosed certain facts about pine, ribes, and the fungus that would determine the success or failure of the proposed control program. Thus was initiated a program of research on blister rust by scientists of federal, state, and private institutions that is still active in 1956.

Cooperative Efforts

The American Forestry Association called a conference in Washington, D. C., January 18 and 19, 1917 to "discuss measures and formulate plans for fighting the disease." Domestic quarantine, both state and national, was urged to control the movement of pine and ribes. Later that year a federal embargo was placed on the shipment of pines and ribes from the East to destinations west of the Great Plains. A plan was developed to ask Congress for $1,000,000 to fight the disease. Education of the public to the seriousness of the blister rust was advocated and conducted energetically.

Although the war years slowed

up control efforts, in 1918 significant conclusions regarding control had been reached. A resolution by the American Plant Pest Committee stated that "the responsibility for control of the blister rust must rest finally with the forest owner." In order not to lose ground already gained, however, it was recommended that federal, state, provincial, and public appropriations be continued "for experimental, demonstration, control, and eradication work in the Eastern States and Provinces." Study had given the assurance that practical blister rust control was feasible in the East, and that wild currants and gooseberries could be found and destroyed at a nonprohibitive cost. Research on many aspects in the life cycle of the fungus was emphasized.

Since World War I, control has been a cooperative effort among federal, state, county, town, and private agencies. The organization of the work and the degree of responsibility has shifted during the years, with the trend from federal to state authority. By 1940, although the federal government had established a policy of continued financial aid in the control program, it was quite thoroughly established that control work on state and private lands is primarily the financial responsibility of state and local owners. The agency in charge of administering specific federal lands is responsible for the control of blister rust on those areas. The U. S. Forest Service "is charged with leadership, coordination and technical direction of the program on lands of all ownerships."

Federal activity has centered at different times in the Office of Forest Pathology, the Office of Blister Rust Control, the Bureau of Entomology and Plant Quarantine, and recently in the Forest Service. Much of the early basic research was done by federal scientists. Federal monies were made available also to many plant scientists from eastern educational institutions for part-time service in blister rust research. Units of the Civilian Conservation Corps as well as workers supported by unemployment relief funds were used for eradicating ribes from many acres of forest lands.

Status of Control

During the past fifty years the basic method of control has continued to be the eradication of ribes. With a better understanding of the pathogen and the relation of environmental factors to pine and ribes infection, modifications have been made in our control procedures.

Today complete eradication of ribes where pine is grown in the Northeast is not considered possible, practical, or necessary. We are now aware that there is no specific width of a ribes-free protective zone that will apply for all natural stands or planted areas in all environments. As a rust-control measure, we now consider it unnecessary to remove infected pines at once, although for salvage it may be desirable; many older trees that become infected may live for twenty or more years afterward and can be harvested without serious cull.

Recently chemical spraying of ribes has been substituted successfully for hand-pulling under certain conditions. We have learned that in some areas it is not practical to attempt to grow and protect white pine from blister rust; the cost and risks are too great. Successful tree surgery practices have been developed to save infected pines of great aesthetic value. Time-saving practices emerged as the passing years enlarged our experience with the rust, e.g., aerial mapping of forested areas to help locate pine concentrations.

The total cost of protection for fifty years has been appreciable, but future costs should be relatively small since much of the initial labor has been accomplished and reinspection and spot eradication is considerably less expensive than the cost of the initial work. Calculated on an annual acreage basis and projected into the future until the protected forest crop will mature, the outlay in the Northeast will be relatively minor. This is particularly true when the fact is faced that, without control efforts having been exercised, many of today's maturing stands would have been killed. Without protection such reproduction as may have occured would be heavily infected and would never attain merchantable size.

Within the New England States, New York, New Jersey, and Pennsylvania the net control area is approximately 11,000,000 acres, of which 4,000,000 acres support white white pine worthy of protection. Much of this net control area has been covered in premaintenance work. The control area acreage now under actual maintenance approximates 8 million acres. The immediate objective of the Forest Service is to bring at least 90 percent of the control program of the Eastern Region to a maintenance basis in 1956.

Maintenance is the status in which the ribes population has been reduced to the point where control is established, and the few remaining ribes will continue relatively static. Premaintenance is the condition in a control area where the ribes are able to increase in size and numbers, and therefore the control area requires periodic reworking.

In the Northeast it is now possible to afford protection to planted white pine from blister rust without excessive cost, providing a proper planting site is selected. There are areas where it is unwise to plant pine because of large ribes populations and unusually favorable weather for the spread of the rust fungus.

Scientists still seek more knowledge about the fungus, its two kinds of hosts, and environmental relationships in the hope that the work and cost of protection still can be reduced. In very recent years, attention has been directed to the genetics of white pine, particularly to the characteristic of rust resistance. There is good evidence that variation in susceptibility to blister rust exists among eastern white pine. Investigations are under way to determine whether it is an inherited charac-

ter and if, through breeding, it can be combined with other desirable characteristics to produce a select forest tree. Seed orchards of white pine that are resistant to blister rust and weevil may be more than wishful thinking.

The Tree and the Disease

Blister rust is found now within most of the natural range of 5-needle white pines native to North America. It was introduced into the Northwest, in British Columbia probably, in 1910, and has spread into the states of Washington, Oregon, Montana, Idaho, Wyoming, and California. In the East the disease occurs from the Lake States and eastern Canada as far south as the Cherokee National Forest in Monroe County, Tennessee. Thus the pathogen has demonstrated its ability to thrive under a wide range of environments favorable for white pine.

A half-century of blister rust has not destroyed eastern white pine as a forest tree. Trees remain and are reproducing themselves even in unprotected areas of high ribes population but damage is severe. Where good protection has been given, extensive damage to white pine is not developing.

After fifty years of blister rust, perhaps we can truthfully say that the rust is not the greatest deterrent to reforesting with white pine in the Northeast. White pine weevil damage, poor growth, early deterioration and death of artificially established stands on poorly chosen sites and soils have discouraged many potential growers. As silviculture, management, and protection practices for white pine improve, the species may be looked upon with greater favor for planting.

Eastern white pine still must be considered an important native forest tree in the Northeast, a natural resource of great value. It has been estimated that white pine wood and the labor associated with its production alone adds $80 million to the annual income of the New England States. In the New York control area in 1954 it was estimated that the present and potential commercial value of white pine approximated $140 million. White pine also contributes greatly to watershed protection, soil conservation, and recreational values throughout the Northeast.

In the control area of the U. S. Forest Service Eastern Region there are about 7½ million acres now growing white pine worthy of protection. Even though the blister rust fungus cannot be eradicated from America, fifty years of experience have proven that the pine forests and planted areas in the Northeast can be protected from the rust menace, but an active control program is essential and must be maintained.

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Changes in Some Physical Soil Properties After a Prescribed Burn in Young Ponderosa Pine

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PRESCRIBED burning, formerly called "controlled burning," is defined as: "The use of fire as a tool in forest protection and management; burning that is confined, according to a plan, to specific areas and intensities of heat" (*2*).

The use of fire as a silvicultural tool has long been recognized as a feasible means to accomplish certain land-management jobs at low cost. Advocates of prescribed burning have stated the case for increased recognition of this practice (*3, 8*). In particular, the use of fire to thin overcrowded stands of ponderosa pine has been a matter of interest in the Pacific Northwest for some years (*5, 6,* and *7*). Effects of prescribed burning on soil fertility in second-growth ponderosa pine have also recently been reported (*4*).

The Study

In 1950, a study of the effects of prescribed burning on timber and range management was begun on the Pe-el area of the Colville Indian Reservation in eastern Washington.[2] The primary objective of the study was to determine the feasibility of reducing competition in an overcrowded stand of young ponderosa pine. One of several major questions to be answered was: "What was the effect of this prescribed burn on physical soil conditions?"

In 1950, a 30-acre area of fairly uniform topography was selected for the prescribed burning study. Seventy-four circular 1/10-acre sample plots were then laid out in grid fashion, with plot centers 2 chains apart in each cardinal direction. Half the plots were within the area to be burned and the remaining half in the surrounding area on which no burning was to be done.

Fifty of the 74 plots were selected for sampling. Twenty-six plots were selected at random in the area to be burned, and 24 in the control area. At a predetermined point near the center of each plot, undisturbed soil core samples of the surface 3 inches were taken in 350 cc. steel cylinders, using a sliding-weight hammer apparatus. This 3-inch sample was taken immediately below the humus layer, and represented largely the A-1 soil horizon. The soil of the study area is weakly developed, and the texture gradation between horizons is very slight. Therefore, minor differences in thickness of the A-1 horizon did not alter the character of the sample.

Laboratory measurements of percolation rate, macroscopic porosity, microscopic porosity, total porosity, and bulk density were made according to methods proposed by the Forest Soils Committee of the Douglas-fir Region (*1*).

The soil of the study area is not classified as to series and type. However, principal profile characteristics are summarized in Table 1.

Unfavorable weather conditions prevented carrying out the burn until the fall of 1952, at which time the fire was applied. The principal fuel was pine needle and brush litter about 2 inches deep. At the time of the burning the upper half of the litter was dry, but the lower part of the litter and the upper few inches of soil were moist to the touch.

The fire was started in late afternoon under conditions of 81 degree temperature and 23 percent relative humidity. However, the temperature soon decreased and the relative humidity rose appreciably. Intensity of the fire was judged to be moderate, and a satisfactory burn was accomplished.

The study area was under snow for several months during the winter after the fire. In the spring of 1953, a second series of soil samples was collected prior to beginning of ground cover growth. These soil samples were analyzed in the same manner as those taken prior to burning.

Results and Discussion

On the area studied, prescribed burning apparently affected percolation rate as well as macroscopic and microscopic pore volume (Figs. 1 and 2, and Table 2). Both percolation rate and macroscopic pore volume were increased after burn-

TABLE 1.—TYPICAL PROFILE OF SOIL FOUND ON THE STUDY AREA

Depth (inches)	Horizon designation	Soil color	Soil texture	Soil structure	Soil consistence
0-½	*L*				
½-2	*F*				
2-4	A_1	Gray brown	Very fine sandy loam	Crumb	Very friable
4-9	B	Light brown	Sandy loam with scattered gravels	Granular	Friable
9-plus	C	Light brown	Sandy loam grading to coarser material and larger gravels with increasing depth	Single grain	Loose

General: Gravels are mainly acidic in origin. Total depth of soil body indefinite. Uprooted ponderosa pines have root systems of more than 8 feet in length to the point of taproot breakage. Soil development very weak.

[1] Forest Service, U. S. Department of Agriculture.

[2] The study was conducted cooperatively between the Colville Agency, Bureau of Indian Affairs, and the Pacific Northwest Forest and Range Experiment Station, U. S. Forest Service. Laboratory analysis of the 1950 soil samples was performed by C. E. Hale, formerly of the Division of Flood Control Surveys, Pacific Northwest Forest and Range Experiment Station.

TABLE 2.—EFFECT OF PRESCRIBED BURNING ON SOME PHYSICAL SOIL PROPERTIES

	Treatment						Treatment comparison[1]	Treatment comparison required for significance at:	
	Control			Burn					
	1950	1953	Diff.	1950	1953	Diff.		95% level	99% level
Percolation rate (cu. in per hr.)	5.66	5.74	+0.08	5.39	8.79	+3.40	3.32	3.270	4.414
Macroscopic pore space (percent by volume)	15.30	15.94	+0.64	15.10	18.19	+3.09	2.45	2.206	2.978
Microscopic pore space (percent by volume)	33.54	35.47	+1.93	35.97	34.06	—1.91	3.84	3.240	4.374
Total pore space (percent by volume	48.84	51.41	+2.57	51.07	52.25	+1.18	1.39	2.730	3.686
Bulk density (grams per c.c.)	1.10	1.18	+0.08	1.05	1.13	+0.08	0.00	0.074	0.010

[1]Differences between treatment differences.

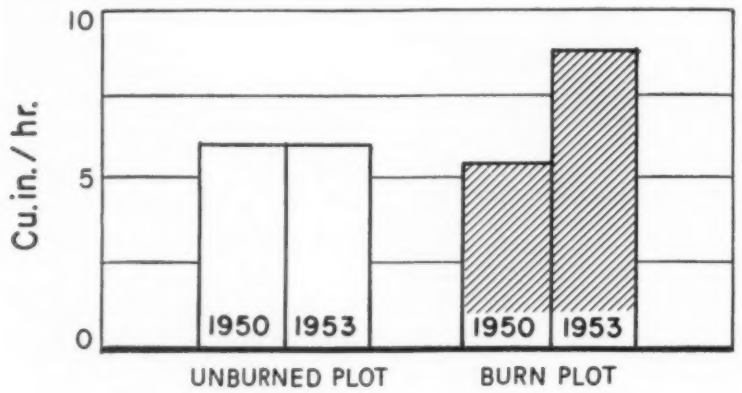

FIG. 1.—Percolation rate.

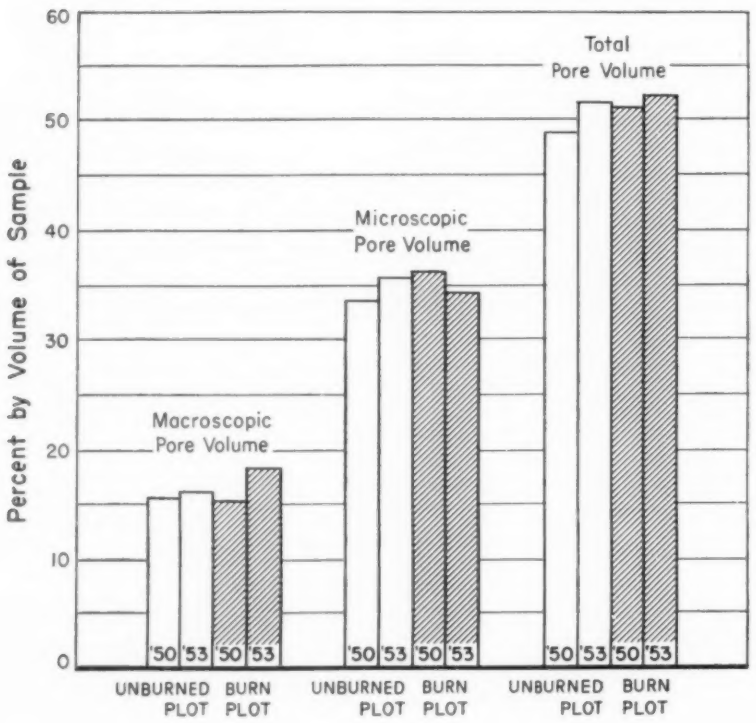

FIG. 2.—Soil pore volume.

ing. Microscopic pore volume was decreased after burning. Total pore volume and bulk density showed no changes (Figs. 2 and 3, and Table 2). The foregoing references to changes in soil properties imply differences significant at the 95-percent level of fiducial probability.

Prescribed burning in the area studied caused a light surface burn in which incorporated humus was not consumed to any significant degree. The fast-moving fire burned principally in the fresh litter. The soil was not baked or reddened as it is sometimes when fires burn in heavier fuels. The increase in macroscopic pore volume and percolation rate may possibly have resulted from some burning of individual dead tree, grass and shrub roots for several inches into the soil. While the fire was not sufficiently hot to consume fine humus mixed with the mineral soil, it is presumed that dry, dead small roots could have carried sufficient low heat to consume themselves for a short distance into the soil. When such roots are thus removed, the volume of large vertical water channels is, of course, increased. Improved soil aggregation caused by liberation of basic materials in the ash may also have contributed to the increase in macroscopic pore volume.

It is, therefore, concluded that prescribed burning under conditions of soil, topography, weather and fuels that were present on the study area did not harm and may

have improved slightly the permeability and associated physical properties of the soil. In making this statement, however, it should be emphasized that very different results might be obtained on areas where topography and fuels would combine to produce a severe burn in place of a light surface burn. Effects of prescribed burning might also be very different on coarse-textured sandy soils with low organic content or on fine textured clay-soils than on the medium-textured soil described in this study.

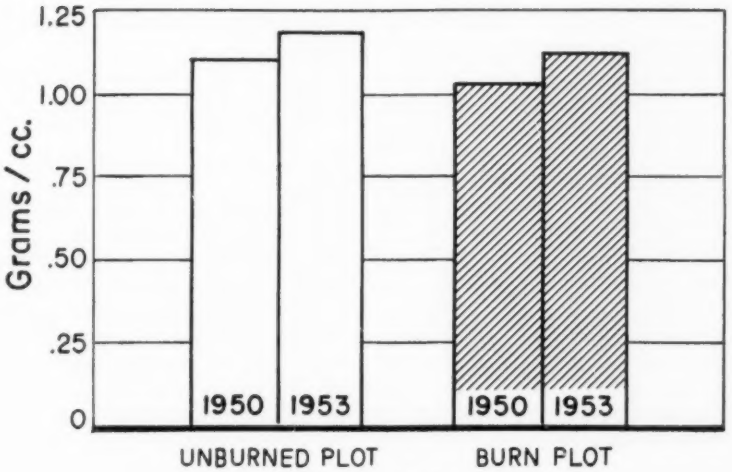

FIG. 3.—Bulk density.

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Department of the Interior Analysis of 1955 Fire Season

The calendar year 1955 forest and range fire losses on Department of Interior lands were, in general, considerably less than those in 1954, as well as being generally below the average annual loss for the previous 10 years.

The total number of fires was 1,951 which is 323 fires less than the number during the previous year, thereby representing average annual number of fires for the past 10 years. The area of federal and Indian land burned over during 1955 was 464,803 acres, as contrasted to 1,624,701 acres in 1954 and with the average annual loss of 1,084,064 acres during the past 10 years.

The number of man-caused fires dropped, with only 1,166 reported for 1955 as compared to 1,444 in 1954. Likewise, there continues to be a reduction in the number of larger fires.

The Fish and Wildlife Service reported emergency conditions at the Okefenokee National Wildlife Refuge in Georgia during the early part of the year. Three fires burned 284,230 acres at that Refuge. This situation was a carry-over of the drought condition existing during the calendar year 1954.

By contrast the Bureau of Land Management reported one of the lightest years in Alaska, where 190 fires burned 23,582 acres of federal land. This is one of the best years of record for the Territory of Alaska.

The National Park Service reported one of its best years. The number of 282 fires for the year was the lowest in 20 years, while the acreage of federal land burned, namely, 4,999 acres was considerably below the 10-year average record.

The Bureau of Indian Affairs reported a very good year, with 837 fires burning 62,560 acres of Indian lands, both figures being considerably below the 10-year average loss for that Bureau.

Percentage-wise, the ratio of man-caused fires to lightning-caused fires remained practically identical with the 10-year average. Of the man-caused fires, camp fires showed a 5 percent increase, whereas smoker fires showed a 7 percent decrease.

A Simplified Method of Correcting for Slope on Circular Sample Plots

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Most projects involving timber cruising or experimental work in forestry include the precise measurement of sample plots in the forest. Circular plots are most commonly used because they can easily be established with a single marker at the center, and because they provide minimum perimeter for a given area of plot.

The sample plots must be kept uniform in horizontal area. In flat country where all the circular plots are taken on a horizontal plane, there is no problem of uniform size. But in steep topography the surface area of sample plots must be increased to compensate for slope. Circular plots projected vertically from the horizontal to a slope become eliptical, as shown in Figure 1, with the long axis running up and down the slope. This elipse contains more surface area than the circle, but it represents the same horizontal area.

On a gentle slope the perimeter of a circular plot can be located by holding the measuring tape in a horizontal position. On steeper slopes it is common practice to measure first the amount of slope along the radius of a particulalr segment of the plot with an Abney level. Then the appropriate correction is taken from a table of radii correction values and added to the radius to compensate for the slope. It may be necessary to measure the slope and adjust the radius at 10 or 15 points to locate a plot boundary accurately.

The purpose of this paper is to present a method that simplifies the task of correcting for slope on circular sample plots.

Problems Related to the Usual Method of Slope Correction

The problems related to slope correction become greater as the slope increases or as the topography becomes more irregular. They are most serious where plots are to be remeasured at later dates and therefore, need fixed perimeters. Improper adjustment for slope may cause errors in timber cruises if the estimator, in trying for speed, approximates the plot boundary between too few points of actual slope measurement.

Some of the main disadvantages of the customary method of correcting for slope are:

1. It is a time-consuming task to correct accurately for slope, especially in rough topography.
2. The plot boundary is not permanently fixed. Even careful remeasurement of the plot with new slope readings is apt to cause some changes in the plot boundary.
3. Field crews that are not extremely careful will make errors because of too few slope measurements or improper allowances for slope.
4. On steep slopes the large variation in length of plot radius makes it difficult for an estimator to become proficient at identifying the *line trees* that must be checked to determine whether or not they are inside the plot boundary.
5. Plot measurement on steep slopes may be hampered by the use of a long tape needed to accommodate the large corrections to be added to the plot radius.

A Different Approach to Slope Correction

An entirely different approach to the problem of slope correction has been developed which is based upon a complete reversal of the usual procedure. Instead of measuring an eliptical plot on the slope, a circular plot with a fixed radius is used. When projected to the horizontal, the plot becomes eliptical, with the long axis lying parallel to the contour instead of up and down the slope (Fig. 2). The horizontal area of each sample plot is controlled by selecting a fixed radius that fits the slope of the plot.

The advantages of this method are:

1. It greatly simplifies and speeds up the work on sloping plots by eliminating repeated radii adjustments for slope.
2. It reduces the plot perimeter with its *line trees* to the absolute minimum.
3. It permanently fixes the plot boundary when the center is marked and the slope class is recorded on the plot record sheet.

Experience with the Simplified Method

This system of correcting for slope was recently used in the forest survey of Formosa. In that extremely rugged island, where some plots had elevation changes of 100 feet per chain, the method seemed very much worthwhile. It simplified the training of Chinese foresters and increased their efficiency on field plots.

An adaptation of the same system has since been used by the Forest Survey in the mountain region of North Carolina with good results. The method has also been used in mensurational studies collecting timber cull, log grade, and volume table data in North Carolina. These studies used an intricate layout of several plot sizes formed by concentric circles around a common plot center in order to sample about the same number of trees in each of six diameter groups.

In each of these cases the plot radii for zero slope and adjusted radii for several slope classes were painted on the steel tape used for plot measurement. For the mensurational studies, the method was further simplified by painting the minimum diameter of the sample trees included in each plot on the tape at the plot radius for zero slope.

Determining the Plot Slope

The adjusted radius to be used throughout any plot is based on the maximum general slope of the plot. Since the slope may vary in different portions of the plot, a rigid procedure is followed in determining the slope. The plot diameter is selected that appears to have the steepest slope. Then the slope is measured in each direction along this diameter from plot center. The mean of these two readings (ignoring plus and minus signs) determines the slope class for the plot.

Slope referred to in this paper (except for Table 3) is measured with the Abney level, using the topographic arc. This measures the number of feet change in elevation per chain (66 feet) of horizontal distance.

Selection of Slope Classes

In this method of slope correction a different plot radius is used for each of a number of slope classes. It is important that these classes fit the topography of the general area to be covered. If the classes are too narrow, the system will become complicated with a large number of slope classes. But if the classes are too broad, the corrections may not average out as representative of the actual slopes, since most slopes might fall near the bottom or top of one of the lower classes.

Probably the best approach is to start with the usual range of slopes within the territory to be covered. Then divide this range into about five classes. Table 1 presents two suggested classifications of slope. The first is for a territory with steep slopes ranging up to 80 or 90 feet per chain. The second classification is for moderate maximum slopes, ordinarily not steeper than 40 or 50 feet of elevation change per chain.

Computation of Adjusted Radii

Slope correction of each plot radius is computed for a circle on the

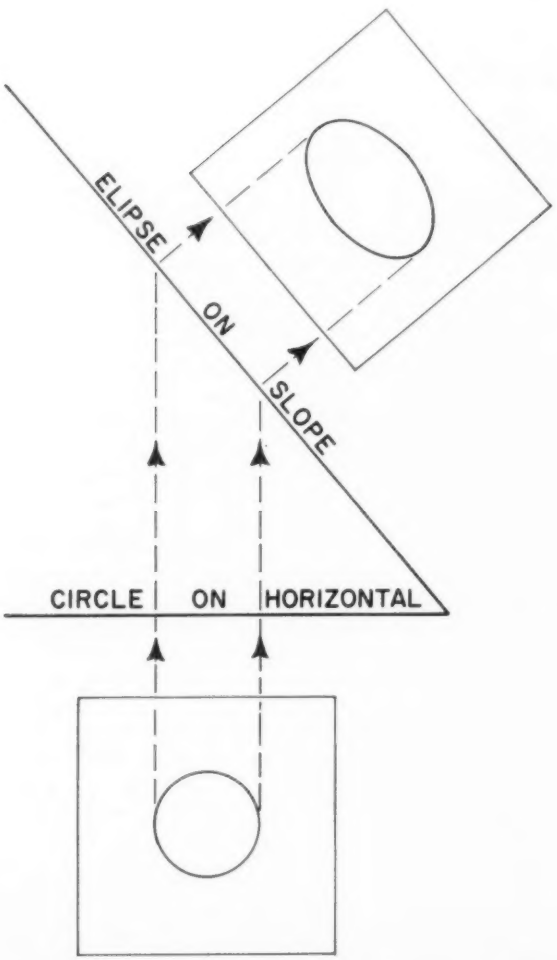

FIG. 1.—A diagram of the usual sample plot on a steep slope. It is circular on the horizontal plane but forms an elipse when projected to the surface of the slope.

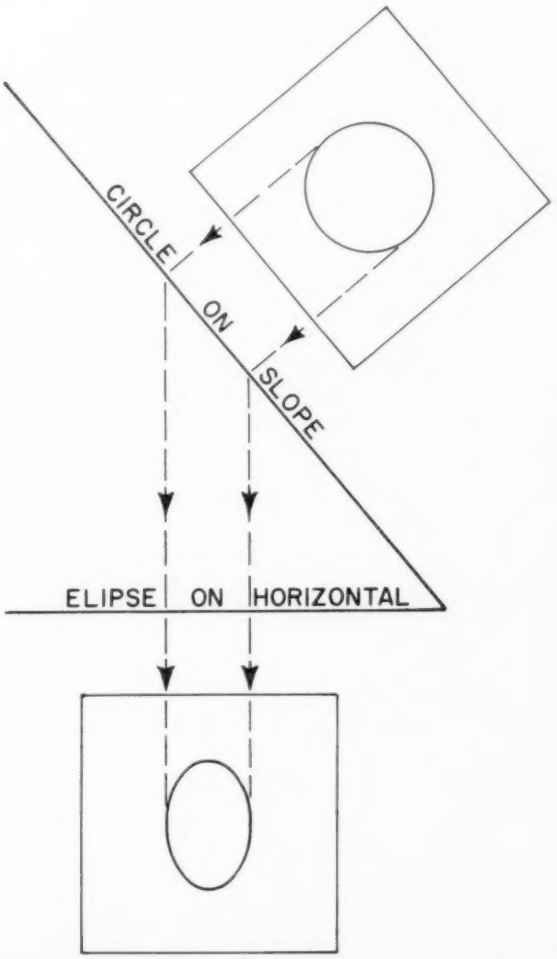

FIG. 2.—The plot used in the simplified method of slope correction forms a circle on the slope. Its projection to the horizontal becomes an elipse.

TABLE 1.—SLOPE CLASSES FOR STEEP SLOPES AND FOR MODERATE SLOPES

Feet of slope per chain	Slope class
Steep slopes	
0-9	0
10-29	20
30-49	40
50-69	60
70-89	80
Moderate slopes	
0-5	0
6-15	10
16-25	20
26-35	30
36-45	40

slope equal in surface area to the eliptical plot of the customary system. Radii for horizontal plots are used for plots in the first slope class, since the tape can be held at or near horizontal in measuring such plots. Radii for other slope classes are computed for the slope of the midpoint of the class.

The radii for both horizontal and sloping plots may be computed directly with the equations for radius listed below. When the horizontal plot radius is known, it may be more readily adjusted for any slope by use of radius slope correction factors. Equations for computing these are also listed.

Let: A=horizontal area of the sample plot
r=radius of the sample plot
C=the radius slope correction factor
T=plot slope in feet of elevation change per chain of horizontal distance as measured with the Abney level, using the topographic arc.
P=plot slope in percent, as measured with the Abney level, using the percent arc.
D=plot slope in degrees above or below horizontal

1. Where measurement of plot radius is in links and plot slope is in feet per chain,

$$r=100\sqrt[4]{\left[\frac{A\ 10}{\pi}\right]^2\left[\left(\frac{T}{66}\right)^2+1\right]}$$

$$\text{and } C=\sqrt[4]{\left(\frac{T}{66}\right)^2+1}$$

2. Where measurement of plot radius is in feet and plot slope is in percent,

$$r=\sqrt[4]{\left[\frac{A\ 43560}{\pi}\right]^2\left[\left(\frac{P}{100}\right)^2+1\right]}$$

$$\text{and } C=\sqrt[4]{\left(\frac{P}{100}\right)^2+1}$$

3. Where measurement of plot radius is in feet and plot slope is in degrees,

$$r=\sqrt{\frac{A\ 43560}{\pi\ (\cos D)}} \quad \text{and } C=\sqrt{\frac{1}{\cos D}}$$

To obtain the greatest degree of simplicity and speed in plot measurement work, it is recommended that some system of slope classification be used, as suggested in Table 1. There might be a slight inaccuracy present on an individual plot due to use of the radius for the class midpoint rather than the exact slope for the plot. But this surely averages out in measurement of the number of plots present in most experiments or in the ordinary timber estimate. However, there may be cases in which this system's feature of fixed plot radius is considered desirable, but the number of plots to be used is so small that it is believed necessary to use actual slope for the individual plot rather than the slope class in selecting each radius. Here one of the above equations might be used to compute each radius or to construct a table of radii or radius slope correction factors for each unit of slope measurement within the range of slopes in the area to be covered.

TABLE 2.—ADJUSTED PLOT RADII FOR SLOPES MEASURED IN FEET PER CHAIN

Slope class (Feet per chain)	Radius slope correction factor	Adjusted plot radii for circular plots of various sizes						
		1/100-acre	1/50 acre	1/20 acre	1/10-acre	1/5-acre	1/4-acre	1-acre
		Links						
Steep slopes								
0	1.00000	17.84	25.23	39.90	56.42	79.79	89.21	178.41
20	1.02221	18.24	25.79	40.79	57.67	81.56	91.19	182.37
40	1.08136	19.29	27.28	43.15	61.01	86.28	96.47	192.93
60	1.16253	20.74	29.33	46.38	65.59	92.76	103.71	207.41
80	1.25355	22.36	31.63	50.02	70.73	100.02	111.83	223.65
100	1.34737	24.04	33.99	53.76	76.02	107.51	120.20	240.38
Moderate slopes								
0	1.00000	17.84	25.23	39.90	56.42	79.79	89.21	178.41
10	1.00570	17.94	25.37	40.13	56.74	80.24	89.72	179.43
20	1.02221	18.24	25.79	40.79	57.67	81.56	91.19	182.37
30	1.04808	18.70	26.44	41.82	59.13	83.63	93.50	186.99
40	1.08136	19.29	27.28	43.15	61.01	86.28	96.47	192.93
50	1.12008	19.98	28.26	44.69	63.19	89.37	99.92	199.83

Marking the Tape

The plot radii should be plainly marked on the measuring tape to save time and prevent errors (Fig. 3). For several years the Forest Survey crews of the Southeastern Forest Experiment Station have used 1-chain tapes with plot radii marked with paint. If the paint is properly applied, the chains can be used 2 or 3 months before needing to be touched up.

The tapes should first be cleaned with turpentine; then the areas to be marked should be roughened with sandpaper before paint is applied. Quick-drying enamel is convenient to use and stays on well.

Where several plot sizes are used at one location, the radius of the smallest plot might be painted red, the next yellow, and the next red, etc., to prevent confusion. Also, the minimum tree diameter included in each plot might be painted beside each plot radius for zero slope. The latter idea has proven helpful in training new crews, since they can put their full attention on measurement techniques rather than on memorizing plot and tree sizes.

Plot Measurement

Let us say that a forest inventory is being made in an area of rather rough topography. Three plot sizes are used around a common center at each location to ob-

tain samples of the desired size in three tree-size groups. A tally is to be made of trees 1.0 inch d.b.h. through 4.9 inches on the 1/50-acre plot, 5.0 through 8.9 inches on the 1/10-acre plot, and 9.0 inches or larger on the 1/5-acre plot.

After plot center has been established, the following procedure might be used:

1. From plot center measure the slope up and down the steepest diameter across the 1/5-acre plot. Say the readings are +23 and −18. The slope class for each plot size will be 20. This is recorded if the plots are permanent or if they may be check cruised.

2. Pin the zero end of the tape down at plot center or tie it to the center stake.

3. Begin the tally working out from plot center along the tape.

4. Using the adjusted radius marked 20 for each plot size, tally trees 1.0 inch d.b.h. or larger on the 1/50-acre plot, trees 5.0 inches or larger on the 1/10-acre plot, and 9.0 inches or larger on the 1/5-acre plot.

5. Mark each tree as it is tallied to avoid duplication or omission.

6. Work out along the chain to the boundary of the 1/5-acre plot, then work back to plot center tallying trees on each plot.

7. Pull the tape out again to the next doubtful *line tree*, and so on around the plot until the tally is complete.

Adjusted Radii for Commonly Used Plots

Adjusted plot radii for some of the most commonly used sample plot sizes are listed in Table 2. All are based upon slope measurement in feet of elevation change per chain of horizontal distance. The slope correction factors may be used to adjust radii for other plot sizes or to adjust radii in other units of measure.

Measurement of slope in percent of horizontal distance is fairly common in forestry work, especially where distances are measured in feet instead of chains. In some countries, although not frequently in the United States, foresters measure slopes in degrees above or below horizontal. Table 3 lists adjusted plot radii of various sizes of plots for one classification of slope in percent and another in degrees. The radii for each zero slope class are those for level plots. All other classes are identified by the class midpoints, which are the slopes for which the adjusted radii were computed.

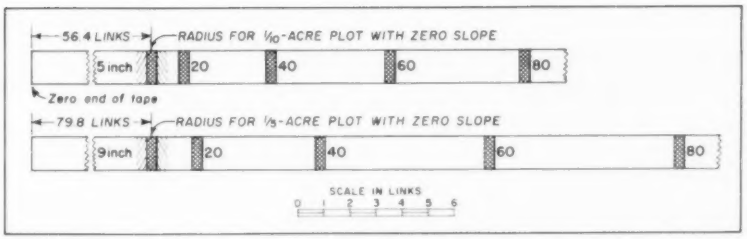

FIG. 3.—Sections of measuring tape showing plot radius markings for level plots and for various slope classes. Link or foot graduations on the tape have been omitted for the sake of clarity.

TABLE 3.—ADJUSTED PLOT RADII FOR SLOPES MEASURED IN PERCENT AND IN DEGREES

Slope class	Radius slope correction factor	Adjusted plot radii for circular plots of various sizes						
		1/100-acre	1/50-acre	1/20-acre	1/10-acre	1/5-acre	1/4-acre	1-acre
		Feet						
Slope in percent								
0	1.00000	11.78	16.65	26.33	37.24	52.66	58.88	117.75
20	1.00985	11.90	16.81	26.59	37.61	53.18	59.46	118.91
40	1.03780	12.23	17.28	27.33	38.65	54.65	61.11	122.20
60	1.07991	12.72	17.98	28.43	40.22	56.87	63.59	127.16
80	1.13165	13.33	18.84	29.80	42.14	59.59	66.63	133.25
100	1.18921	14.01	19.80	31.31	44.29	62.62	70.02	140.03
120	1.24982	14.72	20.81	32.91	46.54	65.82	73.59	147.17
140	1.31167	15.45	21.84	34.54	48.85	69.07	77.23	154.45
Slope in degrees								
0	1.00000	11.78	16.65	26.33	37.24	52.66	58.88	117.75
10	1.00769	11.87	16.78	26.53	37.53	53.06	59.33	118.66
20	1.03159	12.15	17.18	27.16	38.42	54.32	60.74	121.47
30	1.07457	12.66	17.89	28.29	40.02	56.59	63.27	126.53
40	1.14255	13.46	19.02	30.08	42.55	60.17	67.27	134.54
50	1.24729	14.69	20.77	32.84	46.45	65.68	73.44	146.87

The Growth of Mature Red Pine in Minnesota

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Respectively, professor of silviculture, University of Michigan, Ann Arbor, and emeritus professor of forestry, University of Minnesota, St. Paul

THE GROWTH and development of red pine (*Pinus resinosa* Ait.) is of considerable importance in Lake States forestry. Not only was the species important in the original forests, but it is also the species used most extensively for reforestation. Consequently, growth records from the few remaining old-growth stands should provide a clue to the future behavior and a guide to the management of the present young plantations. This paper summarizes the growth and development of two stands over 100 years old in Minnesota, one in Itasca State Park and the other in the Cloquet Experimental Forest. It represents further analysis of the data presented briefly by Spurr and Allison (*3*).

Itasca State Park in northwestern Minnesota contains several thousand acres of old-growth red pine. These stands, as well as the younger jack pine (*Pinus banksiana* Lamb.) stands mingled with them, are the result of a long series of fires long preceding settlement of the area by white men (*4, 7*). In 1923, the junior author established a 5-acre permanent sample plot in a fully stocked mixed red and jack pine stand, then about 113 years old, across the lake west of the forestry camp. All trees were numbered. Diameters have been measured each five years to the nearest 0.1 inch. Calipers were used in 1923 and diameter tape in all subsequent years. Heights were measured in 1933, 1943, 1948, and 1952. Understory development was recorded in 1948 and 1952. At the time of the 1952 remeasurement, 29 years after plot establishment, the area was subdivided into 50 tenth-acre subplots and the exact location of each numbered tree was mapped permitting the reconstruction of growth on each subplot. At this time, a number of minor variations in stand structure and site quality were recognized and mapped (Fig. 1).

At the Cloquet Forest Experiment Station in northeastern Minnesota, a 42-acre red pine tract was completely tallied in 1919 by the junior author and Leo Isaac when the stand was about 99 years old. A comparable 100-percent cruise, using the same 2-inch diameter classes, was made in 1952 using the techniques originally adopted. In addition, growth data are available for the same stand from ten ¼-acre sample plots measured to the nearest inch in d.b.h. in 1939 and 1949. A description of this stand is given by Allison and Brown (*1*).

Following the 1952 measurements, all data were re-tabulated and analyzed using previously published techniques (*5, 8*).

Inasmuch as the records of tree diameters are far more complete than those of tree heights, the basal area values for the years of measurement are more reliable than those of volume. In the ensuing discussion, therefore, growth and stocking are treated largely in terms of basal area although the volume data are also tabulated.

Ordinarily, in preparing local volume tables for recurring measurements of a single stand, the computer must take into account changes in the height-diameter relationship with time. For most even-aged second-growth stands, the height corresponding to a given diameter increases with time. In the present case, it is worthy of note that the height-diameter relationships of the red pine have apparently remained unchanged for each of the four years for which height-growth data were available. There was no statistically significant difference in the volume-line regression solutions (cubic-foot volume plotted over the square of the d.b.h) for these four years. Grouping the data, the common regression was found by least squares to be:

$$CF = 0.198D^2 - 2.45$$

Where CF is the total cubic-foot volume inside bark and D is the d.b.h. The standard error was 2.44 cubic feet or 6.7 percent of the mean volume of 36.55 cubic feet.

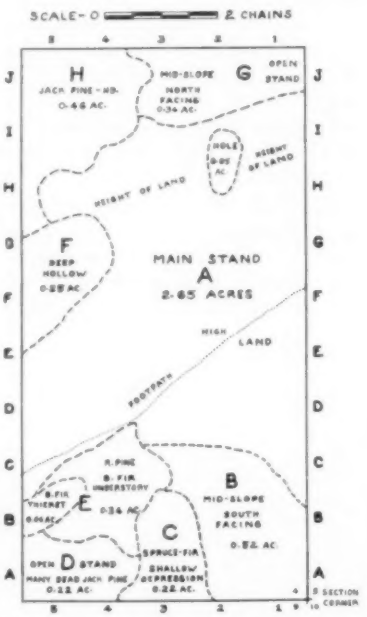

FIG. 1.—The Itasca 5-acre plot in 1952, showing minor variations in stand structure and site. The marginal key refers to the tenth-acre subplots.

Stand Growth

The development of the two stands is summarized in Table 1 for Itasca and Table 2 for Cloquet. Values are on a per acre basis and apply to all the old-growth stand except for the height of free trees, which refers to dominant and co-dominant trees only. Mean diameter is defined as the diameter of the tree of mean basal area in accord with usual practice. The 1923 measurements of the Itasca stand provide a lower estimate of basal area, mean diameter and volume than would have been obtained

TABLE 1.—DEVELOPMENT OF ITASCA RED PINE STAND, 1923-1952 (4.10 ACRES, VALUES ON PER ACRE BASIS)

	Species[1]	1923[2]	1928	1933	Year 1938	1943	1948	1952	Periodic annual change
					Age				
		113	118	123	128	133	138	142	1928-1952
Number of trees	RP	168	166	163	161	160	157	155	−0.46
	WP	23	23	21	20	20	20	19	−0.17
	JP	31	24	18	14	9	6	6	−0.75
	WS	3	3	3	2	1	1	1	−0.08
	Total	225	216	205	197	190	184	181	−1.46
Basal area (sq. ft. per acre)	RP	111	122	126	133	137	142	147	1.04
	WP	10	11	11	12	13	13	14	0.12
	JP	24	19	15	13	8	6	5	−0.58
	WS	2	1	2	1	1	1	0	−0.04
	Total	147	153	154	159	159	162	166	0.54
Mean diameter (inches)	RP	11.0	11.6	12.9	12.3	12.5	12.8	13.2	0.07
	WP	8.8	9.3	9.8	10.5	10.9	11.1	11.6	0.10
	JP	11.8	12.1	12.6	12.7	12.8	12.7	12.5	0.02
	WS	10.2	10.0	10.8	10.9	12.7	9.7	13.0	
	Mean	10.9	11.4	11.7	12.1	12.3	12.6	13.0	0.07
Height of free trees	RP	73	74	75	77	78	79	80	0.25
	WP	(72)	(75)	78	81	84	87	89	0.58
	JP	(77)	(77)	78	78	78	78	78	0.04
	WS			74					
Cubic foot volume	RP	3,589	4,001	4,173	4,438	4,587	4,747	4,951	39.6
	WP	291	330	349	379	405	439	456	5.2
	JP	736	603	482	399	259	181	163	−18.3
	WS	55	48	51	51	35	28	19	− 1.2
	Total	4,671	4,982	5,055	5,267	5,286	5,395	5,589	25.3
Int. ¼ in. board-foot volume	RP	19,250	22,030	23,250	25,050	26,070	27,240	28,650	275
	WP	1,360	1,620	1,780	2,000	2,160	2,380	2,520	38
	JP	4,080	3,400	2,740	2,280	1,480	1,040	940	−102
	WS	300	260	280	290	200	160	110	− 6
	Total	24,990	27,310	28,050	29,620	29,910	30,820	32,220	205

[1]RP—red pine; WP—white pine; JP—jack pine; WS—white spruce.
[2]Diameter was measured with calipers in 1923. Thus, values developed from diameter measurements are lower than they would have been had diameter tape been used as in succeeding years.

TABLE 2.—DEVELOPMENT OF CLOQUET RED PINE STAND, 1919-1952 (42 ACRES, VALUES ON PER ACRE BASIS)

	Species	Year 1919	1952	Periodic annual change from 100-percent cruise 1919-1952	Periodic annual change from 10 ¼-acre plots 1930-1949
		Age 99	132		
Number of trees	RP	79.6	77.9	−0.05	−0.16
	WP	1.7	2.1	0.01	0.12
	JP	10.0	3.7	−0.20	−0.32
	Total	91.2	83.7	−0.24	−0.36
Basal area sq. ft. per acre	RP	92.6	117.3	0.77	0.76
	WP	3.0	3.8	0.02	0.09
	JP	8.1	3.6	−0.14	−0.20
	Total	103.7	124.8	0.66	0.65
Mean diameter (inches)	RP	14.6	16.6	0.06	
	WP	18.1	18.5	0.01	
	JP	12.2	13.5	0.04	
	Mean	14.4	16.5	0.06	
Cubic foot volume	RP	3,173	4,090	28.7	28.4
	WP	109	134	0.8	2.9
	JP	253	116	−4.3	−5.9
	Total	3,650	5,020	25.2	25.4
Int. ¼ in. board-foot volume	RP	18,975	25,194	194	200
	WP	681	842	5	16
	JP	1,422	677	−23	−31
	Total	21,078	26,713	176	185

had d.b.h. been measured that year with a diameter tape as was the case in succeeding years. For this reason, periodic annual change (or increment) is calculated for the period 1928-1952. The height data from the Cloquet stand are too fragmentary to justify tabulation. The mean height of the free red pine, however, is estimated at 73 feet in 1919 and 86 feet in 1952.

Both stands are even-aged post-fire associations growing on sandy glacial outwash with the water table coming within 10 to 20 feet of the surface. From the standpoint of soils and lesser vegetation, the site would be classified as average for red pine. The height data confirm this. At 100 years of age, the Itasca red pine had a mean height of free-to-grow trees of about 70 feet while the corresponding figure for Cloquet was about 73 feet. The greater height growth of the Cloquet stand cannot be attributed clearly to site difference inasmuch as that stand is less dense than the Itasca stand. In well-stocked stands, density has relatively little effect on the height growth of pure red pine stands.

The main impression conveyed by the growth data is that the development of the two stands show remarkable agreement, and that their growth greatly exceeds that predicted by the yield tables for unmanaged, fully-stocked (*2*). Considering the red pine element alone, the denser Itasca stand has shown a net periodic (24-year) annual increment of 1.04 square feet of basal area, 39.6 cubic feet, and 275 board feet; while the more open Cloquet stand gives values for a 33-year period of 0.77 square feet, 28.7 cubic feet, and 194 board feet. By comparison, the values given by Eyre and Zehngraff for red pine on an average site between the ages of 100 and 140 are 0.10 square feet, 17.5 cubic feet, and 87.5 board feet (*2*). The greater net increment of the actual stands is apparently due to their lower density and the thinning effect resulting from the continuing mortality of the jack pine in the mixture.

The record of the continuing mor-

TABLE 3.—DECLINE OF JACK PINE IN ITASCA SUB-STANDS, 1923-1952 (PER ACRE BASIS)

		1923	1928	1933	1938	1943	1948	1952
1803-1811	Age	113	118	123	128	133	138	142
Burns	Number	95	82	59	46	23	14	9
0.22 acre	Basal area	78	74	56	44	22	14	10
	Mean d.b.h.	12.3	12.8	13.2	13.3	13.5	13.8	14.0
	Cubic feet	2,443	2,315	1,773	1,395	716	450	308
	Int. ¼ inch board feet	13,750	13,290	10,270	8,100	4,180	2,650	1,820
1865	Age	50	55	60	65	70	75	79
Burn	Number	102	102	96	85	67	44	28
0.46 acre	Basal area	41	46	47	46	40	28	17
	Mean d.b.h.	8.6	9.0	9.5	10.0	10.4	10.8	10.6
	Cubic feet	1,185	1,338	1,377	1,374	1,213	844	520
	Int. ¼ inch board feet	5,370	6,370	6,750	6,980	6,330	4,480	2,200

tality of the jack pine is of particular interest. In the main Itasca red pine stand of 4.10 acres, the number of jack pine declined from 31 per acre in 1923 to 6 per acre in 1952 while the individual trees that survived made practically no diameter growth over that period. None-the-less, it is worthy of note that some jack pine trees can live as long as 142 years. The northwestern and southwestern corners of the Itasca plot originally contained a preponderance of jack pine in the stand, and have been treated as several stands in the computations. The stand in the southwest corner (area D, Fig. 1) is of the same age as the main red pine stand, while that in the northwest corner (area H) originated following a later fire (1865) that burned in from the west. These areas provide data on the decline of jack pine in pure stands on outwash sand sites in northwestern Minnesota (Table 3), and demonstrate that the decline of the jack pine is due to senility rather than to the competition of the red pine. In the younger stand, the maximum density and volume is reached at about age 60, following which the stand broke up to such an extent that only 28 trees per acre were left at the time of the 1952 measurement when the stand was approximately 79 years old. In the older stand, a numerous jack pine element was still apparent in 1923 when the trees were about 113 years old, but the 29 years of measurement have recorded a decimation of the species. Although the jack pine can live 140 to 150 years and attain diameters of 16 inches or greater on such sites, it shows little growth or vigor after 60 years.

In contrast, white pine (*Pinus strobus* L.) is the most vigorous species in the mixture after 100 years. Not only do the individual white pine trees show the greatest height and diameter increment in the Itasca plot, but there also exists a vigorous understory element of white pine, and trees that were classed as intermediate or suppressed in the early years are now becoming dominant or codominant as the tallest and most rapidly growing of all trees in the stand. On such sites, white pine is clearly a mid-tolerant with perhaps the greatest growth potential of any species.

Finally the white spruce (*Picea glauca* [Moench] Voss) appears to be short-lived. Despite its tolerance and adequate growth, the older trees are gradually disappearing from the overstory, being replaced by younger specimens of the same species.

Density and Growth

The subdivision of the Itasca 5-acre plot into substands and 50 tenth-acre subplots permitted the study of the effect of stand density upon growth. Much that has been written on red pine silviculture has been based upon the concept that growing stock level, usually expressed in terms of basal area, is a critical factor affecting stand growth and yield. On the other hand, the preponderance of world opinion, summarized by the senior author in *Forest Inventory*, is that stand density is not highly correlated with stand growth as long as the site is fully occupied. Using the phrase of Assmann, there is a "critical density" which is the minimum basal area of trees that fully occupies the site. Below this, growth fall sharply off. There is in addition, a higher basal area that represents the maximum carrying capacity of the site; and above this net growth will decline. Within these limits, there is a slight doming of the growth-over-density curve, but no specific density level can be said to be markedly superior to any other.

The basal area data derived from the Itasca tenth-acre subplots are in agreement with this general theory. The 20-year basal-area increment of the red and white pine is plotted over the basal area at the beginning of the period in Figure 2. Each point represents the average of the number of tenth-acre plots indicated. Both the gross growth (excluding mortality) and net growth (including mortality) curves follow the theoretical general pattern. The critical density lies at about 80 to 90 square feet per acre. Above this level, extending to 190 square feet, density is not highly correlated with growth, although there is some indication that the maximum production is obtained when the stand density lies at 110 to 120 square feet per acre. Inasmuch as the height-diameter relationships have remained unchanged throughout the period of study—at least insofar as they could be tested—the conclusions derived from a study of basal area growth can probably be applied in their principles to volume growth.

One portion of the Itasca stand is particularly dense. This is the portion of the stand that lies in the small hollow (area *F*, Fig. 1). When the growth is calculated separately for this quarter-acre area, we may obtain some information as to the maximum carrying capacity of that site for red pine. Here, the total basal area per acre was 195 square feet in 1923. Although, the figure reached as high is 211 square feet in 1938 and 1943, mortality has approximately kept pace with gross growth, and the 1952 basal area

was only 205. We may infer that 210 square feet per acre represents the approximate maximum carrying capacity of average site quality outwash sand for pure red pine in northern Minnesota.

Finally, it may be noted that the net basal area growth of all portions of the Itasca stand, with the exception of the overly dense portion just discussed, has been linear from 1923 to 1952. This red pine stand, from ages 113 to 142, is in the middle phase of its growth curve and has not yet entered into the period of senescence characterized by declining growth rates. A straight-line prediction of growth, based on basal area and not diameter, would give the best estimate of future growth for this stand at any time during this period. That is to say that the growth in terms of basal area has been linear at the same time that the growth in terms of diameter has been decreasing.

Growth by Diameter Classes

Since every overstory tree on the Itasca 5-acre plot was numbered in 1923, it is possible to study the growth of individual trees and diameter classes. Such an analysis serves to indicate what portion of the stand growth is being made by each diameter class and in what diameter classes mortality is concentrated. Diameter limit cuttings can then be postulated so that the most productive diameter classes can be reserved and the least productive cut. By extension, the data can be used for the formulation of general silvicultural rules for intermediate cuttings in similar stands.

This analysis was confined to the 468 red pine growing in the 2.65 acre central portion of the main stand (area *A*, Fig. 1) where the least variation existed both as to site quality and stand density. The tree data were arranged in order of the 1928 diameters, and were then subdivided into twenty diameter classes, each containing 23 or 24 trees. Net growth, mortality, and gross growth were calculated for each class.

The largest twentieth-part of the red pine stand had a mean diameter of 18.2 inches in 1928 and of 19.4 inches in 1952. It comprised 13 percent of the total basal area in 1928 and contributed 13 percent of the total net growth in basal area over the following 24 years. The largest trees within this class, including one 230-year-old veteran having a diameter of 27 inches, made very little growth during this period and were obviously slowing down in their development.

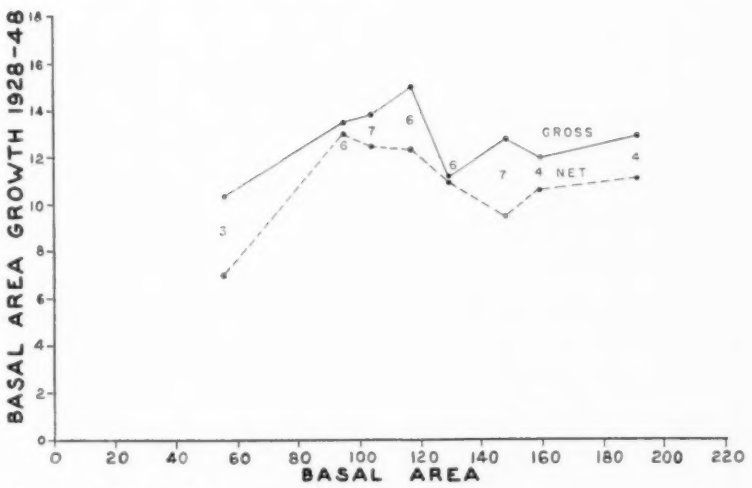

FIG. 2.—Periodic net and gross growth red and white pine. Basal area as related to 1928 basal area. Itasca tenth-acre subplots.

Actually, the largest 80 percent of the trees, those having a diameter in excess of 7.2 inches in 1928 and 8.2 inches in 1952, contributed 99.5 percent of the net growth and 95.2 percent of the gross growth over the 24 years. The smallest fifth of the stand thus made only very minor diameter growth during this period, besides suffering from mortality. It may be considered an inactive part of the stand that may well prove detrimental in that such trees are particularly susceptible to ice, snow, and wind damage.

The basal area growth percent made by each twentieth part of the red pine stand is graphed in Figure 3. The smaller intermediate and suppressed trees comprising the three smallest diameter classes show little gross growth and no net growth. The middle diameter classes, which ranged from 8 to 11 inches in d.b.h. in 1928, were making percentagewise the greatest basal area increment. In contrast, the three largest classes, ranging upwards from 15 inches in 1928, were growing at a lower percentage rate. This, and other analyses not here included, would seem to indicate that while the stand as a whole is still growing at a constant basal area rate and may be considered to be in the vigorous middle period of growth, the largest dominant individuals are approaching senescence as indicated by decreasing basal area growth rates.

Successional Trends

The 29-year record of the Itasca 5-acre plot coupled with extensive field work in the rest of the park provide a picture of the normal secondary succession following fire on sandy outwash soils in northern Minnesota.

First, fires are and have been for many centuries of common occurrence in the area (*1*). Depending upon the time of the fire with reference to season of year and to the seed years of surrounding timber, the area may restock with red pine, jack pine, aspen, or paper birch. A red pine—jack pine mixture is apparently more common than a pure red pine stand, because of the serotinous nature of jack pine cones and the resulting tendency of jack pine to restock after every fire whether or not the red pine is successful in re-establishing itself. On the upland sandy sites, the aspen soon reaches maturity and disintegrates before the stand is 60 years old. At about 60 years, the

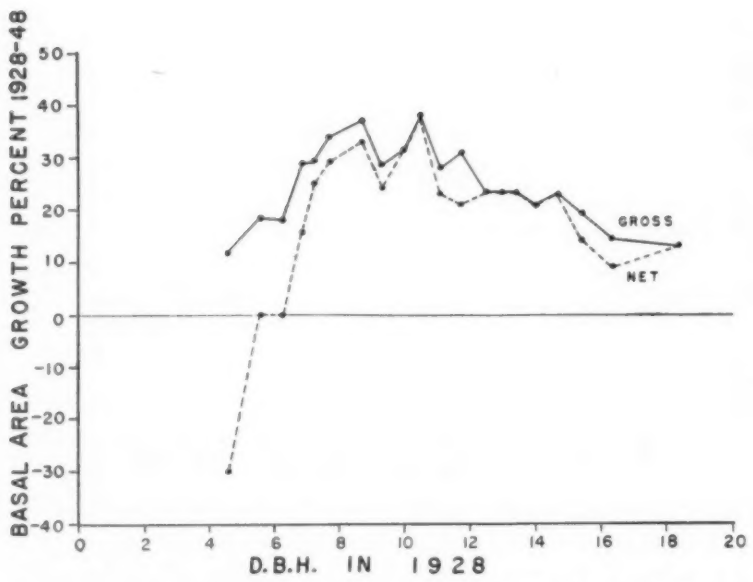

FIG. 3.—Basal area growth percent by diameter class. Itasca red pine. Each point represents one-twentieth of the red pine stems in area *A*, Figure 1.

growth of the jack pine culminates and the species thereafter goes into a long decline, although a few trees still remain at 130 to 140 years. The red pine passed the jack pine in height at about 130 years in the Itasca 5-acre plot.

White pine is at first uncommon in the post-fire pine stands, but comes in irregularly in the following years depending upon the coincidence of seed supply and growing space for the seedlings. Once established, however, it proves mid-tolerant and aggressive in its growth. By the beginning of the second century, the white pine are surpassing the red and jack, becoming the largest trees in the stand. In Itasca Park, the white pine reach diameters of over 48 inches and heights of over 140 feet in contrast to the red pine which seldom exceeds 30 inches or 120 feet in height.

As the pine stand opens up, an understory of shrubs and tolerant trees becomes established. Particularly prominent is hazel (*Corylus* spp.), which owes at least part of its prominence at Itasca to the virtual elimination of tree reproduction during many years of overbrowsing by deer. With the reduction in the size of the deer herd in the 1930's though, an understory of balsam fir, white spruce, and paper birch has become established, being especially dense in the lower-lying portions of the stand. This understory showed little net growth between 1948 and 1952, the number of understory trees per acre decreasing from 101 to 98, while the basal area increased from 13.4 to 14.6 square feet per acre.

As would be expected, the tolerant understory species are doing better than the intolerant. The number of balsam fir (*Abies balsamea* [L.] Mill.) has increased from 48 to 51 per acre and their basal area from 6.3 to 7.6. In contrast the number of paper birch (*Betula papyrifera* Marsh.) has decreased from 24 to 17 and their basal area from 3.2 to 2.7. The white spruce has just about held its own. Neither the fir nor the spruce, though, has demonstrated enough longevity to outlast the 142-year-old red pine, and it is safe to predict that the pine association can continue for at least another century as 250-year-old stands of fair to good vigor are common in Itasca Park. In the absence of fire, the succession will eventually progress to a spruce-fir climax, composed of individuals not now in existence. A forest free from fire, however, is a highly unnatural community in this area that is possible only through stringent protective efforts on the part of man.

Silvicultural Implications

This study of the development of mature red pine stands in northern Minnesota provides an insight into several aspects of the silvicultural management of the species.

First, red pine continues to thrive until an age of 140-150 years and probably much longer. Growth is substantially better than indicated by existing yield tables. The stand remains intact and there is no ecological or silvicultural reason for clearcutting it within this period. Old-growth pine stands, therefore, can safely be preserved for scenic and recreational purposes. At 250 years, individual trees still show satisfactory vigor and growth, even though the stand is seldom intact at that age.

The satisfactory growth of the mature red pine stands studied, as contrasted to the poor growth estimated by published yield tables, is apparently due to the natural thinning effect produced by the gradual mortality of the jack pine and of other short-lived species such as aspen (*Populus tremuloides* Michx.), paper birch, and white spruce. Actually, the admixture of jack pine and other short-lived species is the rule rather than the exception in natural young red pine stands, and this condition is especially favorable to red pine because of the resulting natural thinning.

By extension, if our younger red pine stands are thinned regularly, growth and vigor may be maintained and the stands can be allowed to grow as long as desired. In contrast, the absence of thinning in fully stocked red pine will bring about a stagnation of growth such as indicated in the yield table data. Such unmanaged stands must inevitably be clearcut at a relatively early age if extensive damage by ice, snow, and wind is to be avoided.

Within these mature red pine stands, there exists a large number of trees whose growth is negligible and whose contribution to stand

mortality is high. These include all of the older jack pine and white spruce, all of the suppressed red pine, most of the intermediate red pine, and a few of the oldest dominant red pine. These trees may be cut from the stand without affecting adversely the growth and condition of the remaining stand. In fact, the removal of these trees will make the stand more attractive by increasing the average diameter of the standing trees, and will lessen the danger of ice, snow, or wind damage. Such an operation can scarcely be termed a thinning as it will have little or no effect on the growth of the remaining trees. As a presalvage or sanitation cut, however, it may be recommended as producing revenue at the same time that it increases the health and vigor of the residual stand.

Summary

The growth and development of two red pine stands over 100 years old in northern Minnesota provide information on the ecology of the species that has implications in its silvicultural management. In Itasca State Park, seven successive measurements of numbered trees by tenth-inch diameter measurements have recorded the growth of a red pine—jack pine mixture from age 113 in 1923 to age 142 in 1952. At the Cloquet Forest Experiment Station, comparable cruises in 1919 and 1952 provide information on a similar stand of 42 acres from age 99 to age 132.

In both stands, net growth has substantially exceeded normal yield predictions, being 275 board feet per acre for a 24-year period in Itasca and 194 board feet per acre for a 33-year period at Cloquet. The greater net increment of the actual stands is apparently due to their moderate densities and the thinning effect resulting from the continuing morality of the jack pine in the mixture.

Of the three pine species in the stand, jack pine makes the most rapid initial growth but reaches its maximum development at about 60 years after which it rapidly breaks up although a few trees are still surviving at 140 years. From age 60 to 100, red pine is the most vigorous species, and this species can be expected to maintain its dominance for 250 years or more. White pine is at first uncommon in the stand, but gradually seeds in and becomes established. After age 100, it is the most vigorous species in the mixture and individual stems gradually attain predominant positions, reaching far greater sizes than the red pine. White spruce cannot maintain itself in the stand despite its tolerance because of its lack of longevity.

The smallest 30 percent of the red pine have, over a 24-year period, contributed only 0.5 percent of the net growth and 4.8 percent of the gross growth. Within these mature red pine stands there exists a large number of trees whose growth is negligible and whose contribution to stand mortality is high. These include all of the older jack pine and white spruce, all of the suppressed red pine, most of the intermediate red pine, and a few of the oldest dominant red pine. These trees may be cut from the stand without affecting the growth of the remaining stand adversely. In fact, the removal of these trees will make the stand more attractive by increasing the average diameter of the standing trees, and will lessen the danger of ice, snow, or wind damage.

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Board Foot-Bolt Foot Volume Ratios for White Oak Cooperage Logs[1]

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In the manufacture of stave and head material for tight cooperage, white oak (*Quercus alba*, L.) has no peer as the best available species, because of its natural properties. There are, however, specifications restricting the use of the material. The sapwood is not admitted, while the usable heartwood must be straight grained, free of blow-holes, knots, and other defect.

Since such stringent specifications are imposed, the purchase of unsplit logs is usually avoided because the existence of interior defect is difficult to determine. In practice, logs are cut into short lengths of 23 to 39 inches for head and stave material, respectively, and then split into quarter sections called bolts. Closer inspection of the interior of the log is therefore possible. The board feet volume of the unsplit log is obtained by the conventional scaling method, while in the split log the bolt foot volume is obtained by scaling each bolt. The basis for the bolt foot volume is the measured chord distance, on the smaller cut face, between the two outside radii and points on the circumference inside the bark. When this linear distance is exactly 12 inches, the volume contained in the bolt is accepted as one bolt foot, and for a chord distance of 15 inches, the volume would be 1.25 bolt feet. This volume measure is also referred to as a chord foot and according to Smith (*3*), the cooperage industry throughout Missouri uses the term chord foot rather than bolt foot, although each gives the same volume of a measured bolt. The term chord foot is so-called because of its relationship to the area of a sector of a circle, computed from the equation:

$A = \frac{1}{2} r^2 \theta$, where

A = area of a sector of a circle

r = radius

θ = angle in radians subtended by a chord of a given length.

The term bolt foot is so-called because it is a measure of the volume of a bolt and is determined by measuring the same chord length as for the chord foot. Since confusion may arise with the word cord as a measure of stacked wood, Smith (*3*) suggested the term stave foot. Each measure, however, is an estimate of the identical unit of

[1]Listed as Technical Contribution No. 226, South Carolina Agricultural Experiment Station, Clemson, South Carolina.

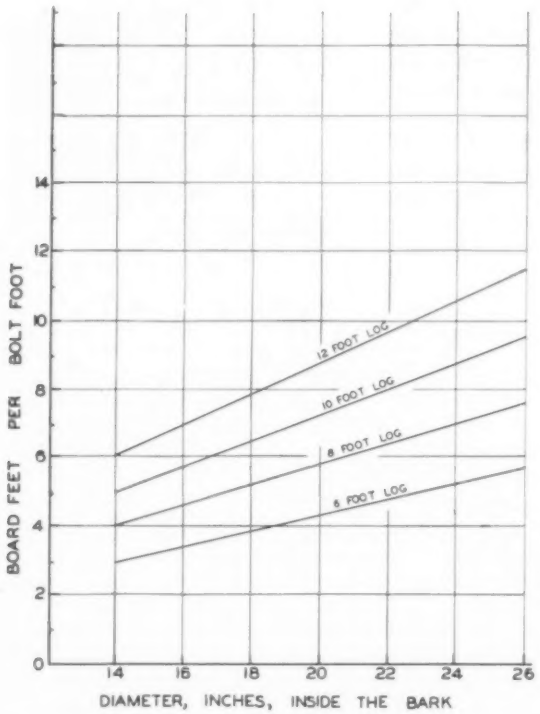

FIG. 1.—Graphic presentation of the board foot—bolt foot ratio for white oak logs cut for head stock.

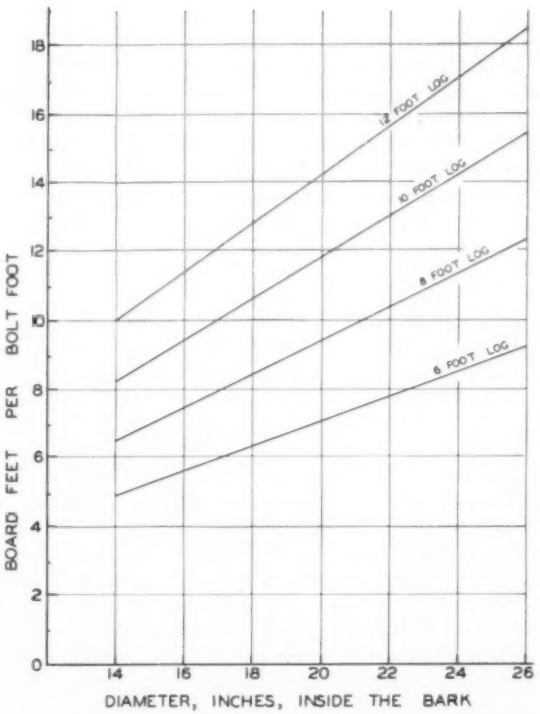

FIG. 2.—Graphic presentation of the board foot—bolt foot ratio for white oak logs cut for stave stock.

wood volume. The local use of the term bolt foot in this section of the Piedmont is the reason for using it in this study.

Merchantable volumes, of white oak trees given in chord feet, are presented by Smith (*3*) based on earlier work of Peck, Sechrist, and Leach (*1*). This volume table enables an estimator to determine chord foot volumes in standing trees of a given breast high diameter by the number of 39-inch cuts. Accordingly, the merchantable volume of a white oak tree 20 inches in diameter breast high and containing three 39-inch cuts (about a 10-foot log) would be 13.7 chord feet. The estimate of volume by the Doyle rule for the same merchantable 10-foot log, assuming the scaling diameter to be 18.5 inches, would be 132 board feet. The volume ratio of board feet per bolt foot for stave bolts according to Table 3 for the above log is 10.98 board feet per 1 bolt foot. Consequently, the estimated volume of the log would be 12 bolt feet, slightly lower than 13.7 chord feet obtained for the standing tree using the volumes of Peck, *et al.* (*1*).

Woodland owners usually understand the board foot volume method for determining log scale when selling stumpage or allocating costs for logging and hauling, but find it difficult to determine comparable cost figures when cooperage logs are scaled and paid for on the bolt foot basis. There exists, however, a rule-of-thumb guide for determining ratios between these two volume scales. For average conditions of log size, the ratio between board-foot volume of a log by the Doyle rule and the bolt-foot volume of the component bolts is 5 to 6 board feet per bolt foot for head bolts and 9 to 11 board feet per bolt foot for stave bolts.

It is the purpose of this paper to develop and present a set of board foot-bolt foot volume ratios for logs of varying conditions of diameter and length, common to the Piedmont oak forests, when converted into head or stave bolts.

Collection of Data

Measurements of diameter and length were taken of each log and its board foot volume determined by the Doyle rule while the bolt foot volume was measured for the component split bolts. The ratio of board foot to bolt foot was computed for each log. These data were collected during 1951-52 from 475 logs converted to 7,125 head bolts and from 400 logs converted to 5,384 stave bolts. Log diameters ranged from 14 to 28 inches and were 8 to 12 feet in length. The linear measure for bolt foot volumes for head and stave bolts ranged from 9 to 18 inches. The net volume relationship between the board foot content of the log and the net volume in bolt feet of the component bolts is the board foot-bolt foot ratio.

Method

Log rules, which express the volume of logs for various diameter and lengths, based on computations derived by formula methods, may be expressed in the general form

$$V=[a+b(D)+c(D)^2]L \qquad (1)$$

where volume (V) is a function of diameter (D) and length (L), while the coefficient a, b, and c are values common to a particular formula rule.

Volume ratio (VR) rather than volume is desired in this study, that is, the relationship of volume between the bolt foot and board feet of the same log. When expressed as (VR) in the above formula it remains a function of diameter and lengths. However, the coefficients a, b, and c in equation (2) are now relevant to these data and study. It follows then that the calculated volume ratios (VR) for (n) logs may be expressed as,

$$\underset{S}{^n}(VR)=a\underset{S}{^n}(L)+b\underset{S}{^n}(DL)+c\underset{S}{^n}(D^2L) \qquad (2)$$

Since actual volume ratios (vr) can be compared to the calculated volume ratios (VR), the method of least squares can be used to calculate the coefficients of equation (2) such that the sum of all logs for (m) days on a weighted basis may be expressed as

$$\underset{S}{^m}w[\underset{S}{^n}(vr)-\underset{S}{^n}(VR)]^2 \qquad (3)$$

The problem of assigning proper weights (w) to the observations must be given consideration. The method used in this study follows the procedure as outlined by Schumacher and Jones (*2*). Accordingly, the weight of an actual volume ratio of a single observation is the reciprocal of the square of its standard deviation, and is designated as $\frac{n}{[\underset{S}{^n}(D^2L)]^2}$

Substituting it for (w) in equation (3) the expression

$$\underset{S}{^m}\left\{ n\left[\frac{\underset{S}{^n}(vr)-a\underset{S}{^n}(L)-b\underset{S}{^n}(DL)-c\underset{S}{^n}(D^2L)}{\underset{S}{^n}(D^2L)}\right]^2\right\} \qquad (4)$$

would be minimum.

The calculation and values of the coefficients a, b, and c of equation (2) appropriate to minimizing the

TABLE 1.—TEST OF SIGNIFICANCE, INDEPENDENT VARIABLES HEAD VOLUME RATIO

Source of variation	Sum of squares	D.F.	Mean square
Total	.00221028	12	
Due to (D^2L)	.00218156	1	.00218156**
Due to (DL)	.00002622	1	.00002622**
Due to (L)	.00000003	1	.00000003
Residuals, independent of D^2L, DL and L	.00000247	9	.00000027

** = Significant at the 1 percent level.

TABLE 2.—TEST OF SIGNIFICANCE, INDEPENDENT VARIABLES STAVE VOLUME RATIO

Source of variation	Sum of squares	D.F.	Mean square
Total	.00009875	10	
Due to (D^2L)	.00009823	1	.00009823**
Due to (DL)	.00000056	1	.00000056**
Due to (L)	.00000004	1	.00000004
Residuals, independent of D^2L, DL and L	.00000012	7	.000000017

** = Significant at the 1 percent level.

expression (4) can be determined by solving the normal equations.

Results

The solution of the normal equations for the data collected on logs utilized for head and stave material yields the following values of the coefficients:

Head ratio
$a = .291280$; $b = -.000003$; $c = .001078$

Stave ratio
$a = -.00234$; $b = .05925$; $c = .00002$

Substituting these values in the formula given in equation 2, we have the predicted volume ratios for both stave and head material.

The test of significance for determining the contributions of the independent variables (L), (DL) and (D^2L) in the regression equations is given in Tables 1 and 2.

Since the effect of length alone carries no significant contribution to the calculation of either head or stave ratios, its coefficient (a) may be dropped from the equation. The values of the coefficients (b) and (c) in the predicted volume ratios then become:

$$\text{Head ratio} = [0.03354(D) + 0.00014(D^2)]L$$

$$\text{Stave ratio} = [0.059(D) + 0.00002(D^2)]L$$

where (D) is the log diameter in inches and (L) is the length in feet.

A graphic presentation of the above equations is given in Figures 1 and 2, and their computed values are presented in Tables 3 and 4, according to diameters and log lengths of 6, 8, 10, and 12 feet.

The standard error of the volume ratio of an individual log may be readily computed. For a given log 20 inches in diameter and 10 feet in length, the numerical value of (D^2L) would be 4,000. Accordingly, the standard error for the header log ratio would be 2.07 board feet per bolt foot while the stave log ratio would be 0.52 board feet per bolt foot.

TABLE 3.—BOARD FOOT-BOLT FOOT RATIOS FOR WHITE OAK LOGS WHEN CUT FOR STAVE STOCK

Scaling diameter of log in inches	Length of log in feet			
	6	8	10	12
	Number of board feet per bolt foot			
14	4.93	6.58	8.22	9.87
16	5.69	7.59	9.49	11.38
18	6.41	8.55	10.68	12.82
20	7.13	9.50	11.88	14.26
22	7.84	10.46	13.07	15.69
24	8.56	11.42	14.27	17.13
26	9.28	12.38	15.47	18.57

Values computed from the regression equation: Volume ratios = $(0.059D + 0.00002D^2) \times$ length. Board foot volumes by the Doyle rule.

TABLE 4.—BOARD FOOT-BOLT FOOT RATIOS FOR WHITE OAK LOGS WHEN CUT FOR HEAD STOCK

Scaling diameter of log in inches	Length of log in feet			
	6	8	10	12
	Number of board feet per bolt foot			
14	2.98	3.98	4.97	5.96
16	3.43	4.58	5.72	6.87
18	3.89	5.19	6.49	7.79
20	4.36	5.81	7.27	8.72
22	4.83	6.44	8.06	9.66
24	5.31	7.08	8.86	10.62
26	5.80	7.73	9.67	11.60

Values computed from the regression equation: Volume ratios = $(0.03354D + 0.00014D^2) \times$ length. Board foot volumes by the Doyle rule.

Discussion

It is quite evident from the data as presented in Figures 1 and 2, that the rule of thumb ratios of 5-6 board feet per bolt foot for head stock and ratios of 9-11 board feet per bolt foot for stave stock is quite satisfactory for average conditions of log diameter and length. Since small logs are not readily accepted for economic reasons and large logs, on the other hand, are in great demand, the rule-of-thumb averages are too low for large diameter logs for all lengths.

Board foot-bolt foot volume ratio tables can be set up by numerically computing these values from the ratio formulas for logs of various diameter and length classes within the range of the data used. The use of these data will enable one to estimate more equitably the bolt foot volumes to be expected from the board foot volume scale of cooperage logs.

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Forestry Education in America[1]

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TECHNICAL training in forestry had been offered at certain European universities for more than a hundred years before the establishment of the first American school of forestry. Although lectures on forestry and tree culture were given in at least 22 land-grant colleges in the United States during the last quarter of the 19th century, this instruction was not professional in character. It was mainly for students of agriculture.

Generally, the lectures were given by teachers of botany and horticulture, and emphasized tree planting, farm woodlot management, and the influence of forests on climate and stream flow. Although the availability of such lectures indicated a growing interest in forestry education, no courses were offered anywhere in America to prepare workers for careers in forestry.

But the advent of professional training was not far distant. In 1898 forestry instruction began at Cornell University, the first institution of collegiate rank to develop a forestry curriculum, and at the Biltmore Forest School in North Carolina, which offered a one-year course in applied forestry. Both schools were subsequently discontinued.

Yale University set up a full forestry curriculum in 1900, and now enjoys the distinction of having the oldest forestry school in continuous operation in the Western Hemisphere. Other colleges and universities followed rapidly.

In 1903 the University of Michigan and Michigan State College established forestry curriculums, as did the Pennsylvania State Forest Academy at Mont Alto, the University of Maine, and the University of Minnesota.

In 1904 three additional institutions set up courses: Iowa State College, Harvard University, and the University of Nebraska which offered forestry instructions in connection with horticulture, then later dropped the work. In 1905 Colorado College started a course, but discontinued it in 1934.

In 1906 Oregon State College and the University of Georgia began training in forestry, but the latter institution was not very active during its first two decades.

In 1907 professional instruction began at Pennsylvania State College, the University of Washington, and Washington State College. In 1909 the University of Idaho set up its forestry work.

In short, up to the period of World War I, 24 schools had been established in the United States, and 20 were still in operation. Most were in land-grant colleges and offered a four-year undergraduate curriculum. Yale had the only wholly graduate school. Manifestly, increasing employment opportunities in federal and state forestry work and the attraction of young men to forestry as a career were creating demands for professional education that the colleges and universities were not reluctant to fulfill.

Although the first two American schools (Cornell and Biltmore) were headed by German foresters, professional forestry education in the United States was characterized from the start by a typically fresh and independent outlook. With the primary aim of training men for the practice of a profession just coming into existence, the early schools were quite different in certain aspects from their European prototypes. The entire conservation movement, including education, was influenced by the crusading zeal of Gifford Pinchot and Theodore Roosevelt. An essential purpose was to reverse the trend of forest destruction and bring about the management of many million acres of publicly owned woodland that had been acquired and was being acquired by the federal government and the states. Forestry educators entered into this program with fervor and serious intent.

Accordingly, during the early decades of professional education there was a marked shift in emphasis from subjects originally adapted from European training to those that better served American needs. A major influence on all schools was the character of the examinations given by the U. S. Civil Service Commission to recruit junior foresters for positions in the federal government. Forestry education, from a virile seed of indigenous origin, was growing into a lusty tree typically American in root, stem, and branch.

Accrediting Forestry Education

With the creation of so many new schools so fast, some leaders in the profession became apprehensive about the maintenance of professional standards. During the 1920's several prominent educators proposed that a study be made of "the education of men preparing for the profession of forestry."

This study was made possible by a financial grant to the Society of American Foresters from the Carnegie Corporation of New York. It resulted in the book *Forest Education* by Graves and Guise, published in 1932 by the Yale University Press.

Using this study as a foundation, the Council of the Society next authorized an examination of each school to determine the minimum standards of training essential to qualify graduates for membership in the Society in the junior professional grade. This examination, started in 1933, resulted in a list

[1]Adapted from an address given at the 50th anniversary dinner of the Oregon State College School of Forestry, Corvallis, March 3, 1956

of 14 approved schools. Six additional schools were declared eligible for approval provided certain standards were met. Thus, the principle of accrediting was first applied to professional forestry education in America.

Accrediting has continued as a permanent activity of the Society of American Foresters. The work is carried on by the Committee for the Advancement of Forestry Education.

Current Status of Forestry Education

As of May 1956, 38 colleges and universities in the United States offer instruction in forestry at the professional level. Two of these—Duke and Yale Universities—offer graduate degrees only. Of the 38 institutions, 26 are accredited by the Society of American Foresters. The remaining 12 have not yet met the standards for accrediting.

Since the first forestry degree was awarded in 1900, the schools will have granted (through June 1956) approximately 24,400 bachelor's degrees and 4,500 master's degrees. Probably 90 percent of the degrees are in general forestry; the other special fields being wood technology, range management, wildlife management, forest recreation, and general conservation. The exact number of doctor's degrees awarded during the past half-century is not known; such statistics as are available indicate a total of about 450.

Perhaps the most serious threat to the establishment and maintenance of high educational standards in forestry is the constant possibility of new schools inadequately financed and inadequately staffed. Since World War II certain college presidents, including presidents of teachers colleges, have proposed establishing curriculums in forestry with little or no conception of what such curriculums on the professional level involve in cost, manpower, and facilities. Because of this possible, and in some cases actual, proliferation of weak forestry curriculums, the Society of American Foresters flatly recommends against the establishment of new schools for professional training in forestry unless adequately financed, staffed, and housed from the start.

In truth, the major problem in forestry education—a problem that appears to be general in education for the professions—is how to strengthen the weak institutions. Forestry cannot advance on a progressive educational front with one-quarter of the professional schools unable to meet the standards of accreditation, standards which in the opinion of many forestry educators are already too low.

Expanding Employment

According to estimates by the Society of American Foresters, there are now in America about 17,000 foresters working in forestry and in closely related fields. By closely related fields we mean occupations such as arboriculture, range management, wildlife management, watershed management, soil conservation, and manufacture of forest products, to name a few.

It is quite likely that by 1960 the number of foresters so employed will approach 20,000, and by 1975 may exceed 35,000.

The growth of our profession, while not spectacular, has been sound and steady. Every year new kinds of jobs come into existence where none existed before. Consider, for example, the growing field of forest tree improvement, more narrowly called forest genetics. Although there are today, relatively speaking, a mere handful of workers in forest genetics, it is conceivable that in another two decades there may be hundreds.

If we reach the goal of 35,000 practicing foresters in 1975, by whom will they be employed? We may confidently expect the federal and state governments to continue their current activities, with considerable expansion likely in intensified protection, in research, and in public-private cooperative management assistance. As timber on once cutover and burned over public lands approaches economic maturity, additional foresters will be required for its management and disposal. But, whereas, more foresters will be needed for the management of publicly owned woodlands, any appreciable expansion of present public forest holdings is unlikely, in my opinion.

Should present trends continue in the pattern of professional employment, and assuming no national economic upsets such as the depression of the 1930's, we have reason to expect that at least half the 35,000 foresters predicted by 1975 will be working in private and industrial fields. Predominantly, they will be employed by pulp and paper companies.

The number of foresters self-employed and in consulting work will doubtless increase. Consulting work is still only on the threshold of public recognition. But as more consulting foresters perform more satisfactory and profitable services for their clients, the more this business will grow. From about 200 consulting foresters today it is possible that nearly 1,000 will be serving private timber owners twenty years hence.

But will 35,000 foresters in 1975 be enough? Enough, that is, to do the forestry job that needs to be done in America? The answer is, "No."

The age and quality of the second growth on the nation's public forests—including military reservations whose acreage in the aggregate is considerable—is already posing problems. Its management will have to be more intensive than it has been in the past, and more foresters must be employed to do it.

Even the most superficial reading of the Stanford Research Institute's report on *America's Demand for Wood, 1929-1975* and the Forest Service's Timber Resource Review indicate indirectly but unmistakably the extent to which foresters will be required. If the national demand for forest products, as foreseen by these organizations, can be considered a reasonably accurate forecast, I for one believe that the predicted demand will not be met unless there are sufficient foresters available to grow the wood.

To be more specific, meeting the

demand for pulp and paper products will require a great intensification of forest practice both on industry-owned lands and on other producing lands from which the mills obtain their wood. Already the pulp and paper industry is the largest single private employer of foresters, and the quality of its forest management is generally higher than that practiced by any other group of private owners. Yet what the industry is doing today in forestry, progressive as it is, will be as nothing to what it may have to do to grow the wood to meet its insatiable needs. Increased planting and silvicultural work on company-owned as well as on other producers' lands, expansion of company timber holdings, and stepped up protection from fire, insects, and disease will provide employment opportunities for several thousand more foresters. The number currently employed by the industry is probably close to 2,000; this number may possibly double in another ten years, and then redouble by 1975.

Are New Schools Needed?

Returning now to the subject of education, we naturally ask ourselves whether this predicted expansion in our professional employment will require the establishment of additional schools of forestry. As forest practice becomes more intensive and scientific, which it most certainly will, the quality as well as the quantity of trained men must go up.

Forestry educators, who after all are the persons best qualified to express an opinion, believe that our existing schools have sufficient capacity to train all the foresters likely to be needed in the foreseeable future. Altogether, our 26 accredited schools, if filled to their optimum capacity and fully staffed, could double the present number of graduates.

The Society of American Foresters has been criticized for allegedly trying to limit the number of schools and for discouraging new schools from starting. This is not true. The Society would not oppose a new school adequately staffed, adequately financed, adequately housed, and capable of meeting our very liberal standards of accreditation. But with 12 existing schools unable or unwilling to meet those standards, the question logically follows, "Should we not strengthen those institutions that now have weaknesses, before starting more?"

SHOWN above are four safety award plaques—no, that's not right—shown above are four ladies holding four plaques. The ladies are from the Washington office of the U. S. Forest Service and together proudly claim a total of 16 grandchildren. They also proudly display a total of four National Safety Council Awards won by the Forest Service in the Wood Products Section Forestry Contest for 1955. Shown left to right are: Mrs. Florence McGindley, with Pacific Northwest Forest and Range Experiment Station Award; Mrs. Elizabeth Puryear, with North Central Region Award; Mrs. Ethel Kamm, with Central States Forest Experiment Station Award; and Mrs. Helen Payne with Intermounutain Forest and Range Experiment Station Award.

Strength and Related Properties of Tanoak

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Standard destructive tests on 300 small, clear, specimens of tanoak from southwestern Oregon showed that the strength and related properties of the wood are much like those of the oaks. Similarity in wood characteristics suggests the likelihood that the estimated 1,700,000,000 board feet of tanoak saw timber in Oregon could be used for the same products as those for which oaks are satisfactory.

TANOAK (*Lithocarpus densiflorus* [Hook. & Arn.] Rehd.) is one of the Pacific Coast's more abundant hardwoods, yet physical and mechanical data on the species are scant.

In southwestern Oregon, the trees usually range from 2 to 4 feet in diameter breast high, and from 70 to 90 feet in height. Maximum size is about 5 feet in diameter by 150 feet in height. Forest-grown trees have clear, straight boles for considerable heights (Fig. 1). Best development is reached on deep, rich, moist but well drained, gravelly, and sandy soils in admixture with redwood, Douglas-fir, Oregon white oak, chinquapin, and California black oak.

The natural range of tanoak is a narrow coastal belt approximately twenty-five miles in width extending from the Umpqua River of Oregon in the north to the Santa Inez Mountains of California in the south. A conservative estimate (*4, 5*) in 1948 placed the probable stand in southwestern Oregon (11.1 inches and greater d.b.h.) at 870,500,000 board feet. A later estimate in 1955 by the California Forest and Range Experiment Station placed the volume of tanoak saw timber in Oregon at 1,700,000,000 board feet. The general range in Coos, Curry, and Josephine counties of potentially important tanoak stands is indicated in Figure 2.

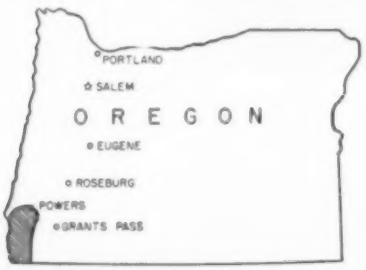

FIG. 1.—Principal stands of tanoak in southwestern Oregon.

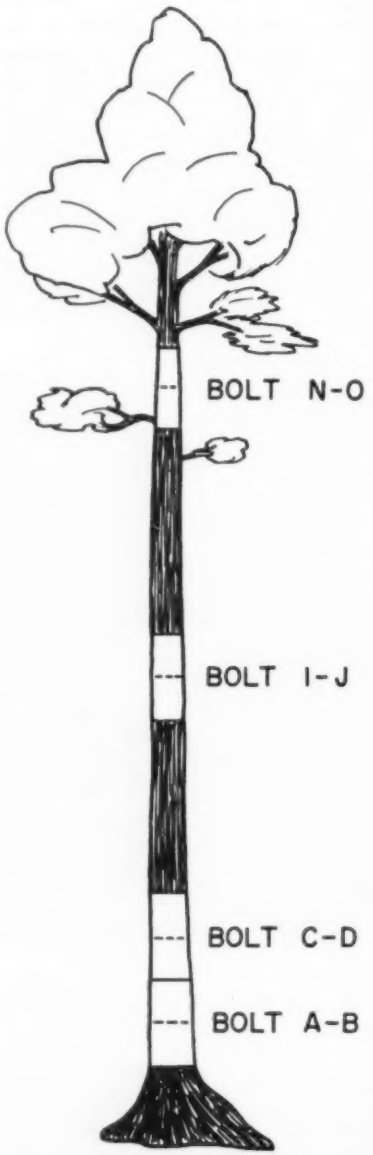

FIG. 2.—Method of bolt selection for trees of 24-inch and greater d.b.h.

The wood of tanoak is heavy, hard, and strong. Logs have thick sapwood that is low in durability, although easily treated with preservatives. After aging, sapwood and heartwood are difficult to distinguish; both age to dark reddish brown. Growth rings are hardly visible; the combination of oak-type rays and lack of distinct growth rings results in close resemblance of rotary cut tanoak veneer to riftsawn oak veneer.

Commercially valuable for its bark, tanoak has provided for several decades an important source of high-grade tannin used by the thick-leather industries. As a result, the harvesting of bark has become an established seasonal occupation which leaves in its wake peeled and discarded logs; an annual loss of several million board feet of potential hardwood lumber or veneer.

The feasibilty of using tanoak in western hardwood lumber production was pointed out as early as 1911 by H. S. Betts (*2*), and again in 1928 by W. J. Baker (*1*). However, only slight use is yet made of the potentially valuable wood from this species.

Objective

The purpose of the present study was to determine the strength and related properties of tanoak as an aid in finding suitable outlets for wood products from this tree.

Material Selection

The assembled information on tanoak resulted from standard destructive tests of 300 small, clear, specimens cut from six representative trees felled in July, 1951. Three trees were selected from the northern limits of the range ap-

proximately twenty miles inland near Powers. The remaining trees were cut near Brookings on the southwestern coast of Oregon. Some trees were cut close to sea level, others came from much higher elevations. The method of selection provided trees from high and low elevations both on the coast and inland, and from the northern and southern limits of the Oregon range.

Properties of tanoak trees from Humboldt and Trinity counties, California, have been assessed in report 2041 of the Forest Products Laboratory, U. S. Forest Service, *Specific Gravity, Shrinkage, and Strength of Tanoak*, by B. H. Paul, *et al*, October 1955.

The six trees used were selected at random with no effort made to classify them according to rate of growth, diameter, or height. The average d.b.h. for the six trees was thirty inches; their average height was one hundred feet. In freshly felled trees, growth rings and heartwood and sapwood were indistinguishable. A ring count of specimens at time of test disclosed an average of fifteen annual growth-rings per inch for all material, with a range from nine to thirty.

Eight-foot test bolts (Fig. 3) were taken from the entire merchantable length of two trees in accordance with A.S.T.M. (Ameri-

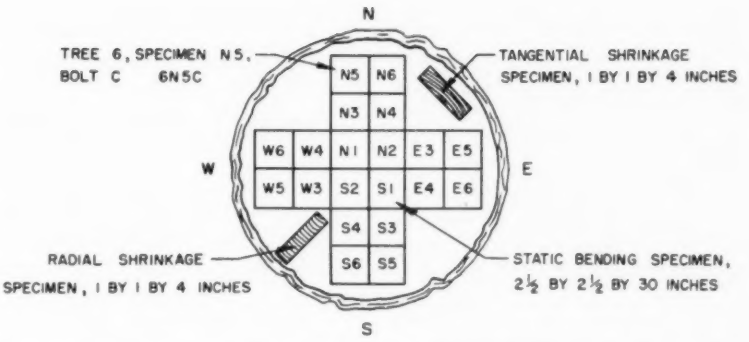
N
S
E
W
TREE 6, SPECIMEN N5, BOLT C 6N5C
TANGENTIAL SHRINKAGE SPECIMEN, 1 BY 1 BY 4 INCHES
RADIAL SHRINKAGE SPECIMEN, 1 BY 1 BY 4 INCHES
STATIC BENDING SPECIMEN, 2½ BY 2½ BY 30 INCHES
N5 N6
N3 N4
W6 W4 N1 N2 E3 E5
W5 W3 S2 S1 E4 E6
S4 S3
S6 S5

FIG. 3.—Cutting plan showing breakdown of individual bolts into static bending and shrinkage sticks from which all other specimens were cut.

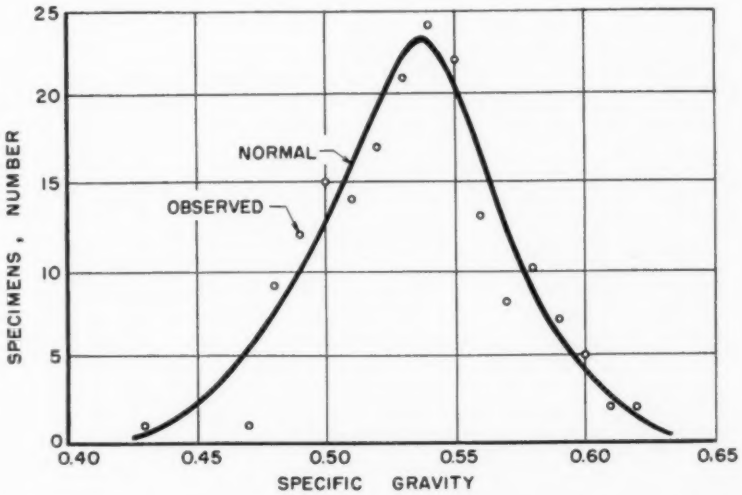

FIG. 4.—Specific gravity of tanoak based on volume when green and weight when oven-dry. Coefficient of variation: 6 percent.

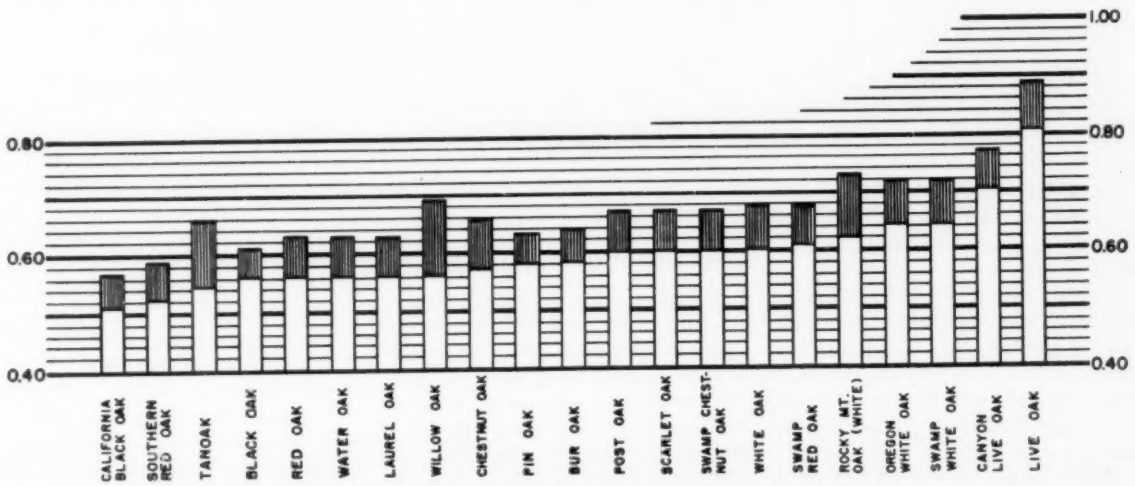

FIG. 5.—Specific gravity of oaks[1] based on oven-dry weight and volume at time of test.

[1]Values for oaks taken from Markwardt, L. J., andT. R. C. Wilson, Strength and related properties of woods grown in the United States. Tech. Bul. No. 479, U. S. Dept. Agric. 1935.
Values for tanoak were from test specimens.

TABLE 1.—STRENGTH AND RELATED PROPERTIES OF TANOAK

Property; A.S.M.E. Test	Relative strength green (Oak=100)	Property values Green[1]	Dry[2]
Specific gravity[3]		0.54	0.66
Static bending			
Fiber stress at elastic limit, PSI	92	4421	6963
Modulus of rupture, PSI[4]	105	8866	16,300
Modulus of elasticity, 1000 PSI	106	1321	1800
Work to elastic limit, in.-lb. per cu. in.	84	0.95	1.58
Work to maximum load, in.-lb. per cu. in.	94	11.19	17.91
Compression parallel to grain			
Fiber strength at elastic limit, PSI	85	2420	4453
Maximum crushing strength, PSI	110	4029	7584
Compression perpendicular to grain			
Fiber stress at elastic limit, PSI[5]	70	694	1078
Toughness[6]			
Radial, in.-lb.	—	256.0	330.6
Tangential, in.-lb.	—	251.6	365.9
Hardness[7]			
End, lb.	83	957	1639
Side, lb.	83	947	1406
Shear parallel to grain			
Maximum shearing strength, PSI	93	1249	2184
Cleavage			
Load to cause splitting, lb. per in. of width	119	503	467
Tension perpendicular to grain			
Tension, PSI	93	731	645
Shrinkage, green to oven-dry based on oven-dry vol.			
Radial, percent		5.5	
Tangential, percent		10.0	
Volumetric, percent		14.9	

[1]Saturated; 120 percent moisture content.
[2]At 12 percent moisture content.
[3]Specific gravity oven-dry based on volume green and dry respectively.
[4]See Table Number 3.
[5]See Table Number 3.
[6]Specimen size, 2 cm square in cross section, 28 cm long, 24 cm gage length.
[7]Load to imbed 0.444-in-diameter ball to one half its diameter.

TABLE 2.—RELATIONSHIP OF TOUGHNESS AND SPECIFIC GRAVITY TO HEIGHT IN THE TREE

Bolt	121 Pieces tested green			363 Pieces tested dry[1]	
	Height in tree	Specific gravity	Toughness	Specific gravity	Toughness
	Feet		*Inch-Pounds*		*Inch-Pounds*
0	54	0.56	180.1	0.67	309.2
N	50	.56	—	.66	306.6
J	38	.55	266.2	.67	345.5
I	34	.56	—	.66	342.3
D	18	.54	278.0	.66	340.0
C	14	.54	—	.65	328.8
B	10	.52	277.7	.66	435.1
A	6	.52	—	.62	338.0

[1]Average moisture content of 12 percent.

can Society for Testing Materials) selection methods for trees of twenty-four-inch and greater d.b.h. Test material from the other four trees was restricted to the *C* and *D* bolts only. As each test bolt was cut, it was numbered, its north side marked for later orientation, and the ends painted with two coats of aluminum paint to prevent end-checking.

The bolts were quartered at a small mill to facilitate handling. The quartered bolts were stored at a temperature of 40 degrees F. until cut into 2½- by 2½- by 30-inch rough sticks.

Preparation of Test Specimens

Test specimens were made in accordance with A.S.T.M. specifications, with one exception as noted in the following paragraph. Eight-foot composite bolts were formed from adjacent four-foot tree sections by interchanging half the test sticks from each section. One of the resulting four-foot bolts was used in testing material in the dry (12 percent moisture content) condition, and the other provided material to be tested green (saturated).

The cutting plan used in reducing the composite bolts to individual test sticks is shown in Figure 4. Sticks were cut initially 2½ by 2½ by 30 inches in size to allow for shrinkage during airdrying, and later were planed to standard 2- by 2- by 30-inch test size. Sticks to be tested dry were open-piled for six months prior to storage in the Laboratory's standard (12 percent equilibrium moisture condition) room, where they were allowed to reach an equilibrium moisture content. Approximately 50 percent of these pieces later were reduced in size to 1½ by 1½ by 20 inches[1] to eliminate crook and twist encountered during airdrying. Fiber stress consistent with that imposed in testing the larger sticks was obtained by reducing the beam span to 18 inches and increasing the machine head speed from 0.1 to 0.54 inch per minute. It was believed that no significant difference in strength property values would be caused by this change in specimen size.

Physical Testing

Standard testing procedures were used on both green (saturated) and dry (12 percent moisture content) specimens in making the following tests: static bending, compression parallel to the grain, compression perpendicular to the grain, shear parallel to the grain, tension perpendicular to the grain, cleavage, hardness, toughness, radial shrinkage, tangential shrinkage, specific gravity, and volumetric shrinkage.

The standard impact bending test was omitted for lack of a suitable machine on which to make the test.

Testing equipment used consisted of a 20,000-pound-capacity Tinius Olsen universal testing machine with an automatic load-deformation plotter, a second Tinius Olsen universal machine of 120,000-pound capacity (for compression tests),

[1]An exception to A.S.T.M. specifications.

and a Baldwin Madison-type toughness machine.

Results of Strength and Related Tests

Average property values resulting from a series of standard tests on small, clear specimens of tanoak are given in Table 1. In this table the relative strength of green (saturated) tanoak was compared with the corresponding average values for all oaks (*3*), assigning to oak the arbitrary value 100. Figures greater than 100 indicate strength values above the average for oaks.

Tanoak appeared to resist splitting more than do the oaks, and was stronger parallel to the grain. In compression perpendicular to the grain, however, tanoak was not so strong as the average for the oaks (Table 1). Average values for toughness were relatively high compared with those in existing data for several hardwood species. Lack of similar data for all oaks, however, made comparison of toughness impossible in Table 1. Test specimens from bolts *O* and *N* were less tough than were pieces from lower bolts (Table 2).

Specific gravity determinations for tanoak were made on 337 specimens selected from all trees tested (Fig. 5). The resulting average specific gravity values were compared with those of 20 oaks in Figure 6. Based on oven-dry weight and volumes both green and oven-dry, results indicated that the specific gravity of tanoak was approximately 9 percent lower than the average value for the oaks. Determinations from the pith out and from the base to the 64-foot height were made on trees 1 and 5. Variation in specific gravity because of position in the cross section was not sufficiently consistent to warrant noting. The lowest bolts apparently had specific gravity slightly lower than that of higher bolts (Table 2).

The coefficient of variation for specific gravity determined in the study was 6 percent for wood in the green condition and 7 percent for oven-dry material. Two thirds of the test values from the material tested green fell between the values 0.50 and 0.58. For the oven-dry material, two thirds of the values fell between 0.60 and 0.72 for a normal frequency distribution. The frequency distribution for specific gravity values determined on the oven-dry weight and the green volume is shown in Figure 4.

Variation in strength properties of tanoak specimens tested is indicated in Table 3. Average values for side hardness, modulus of rupture, and compression perpendic-

TABLE 3.—VARIATION OF SEVERAL STRENGTH PROPERTIES FOR TANOAK TESTED GREEN

	Number of pieces	Specific gravity	Load to embed 0.444-inch ball to ½ its depth
			Pounds
Side hardness			
Average	160	0.51	947
High 10%	16	.58	1,080
Low 10%	16	.50	790
Modulus of rupture			Pounds per square inch
Average	75	0.54	8,866
High 10%	8	.54	10,431
Low 10%	8	.53	6,472
Compression perpendicular to the grain			Pounds per square inch
Average	51	0.54	694
High 10%	5	.53	897
Low 10%	5	.57	414

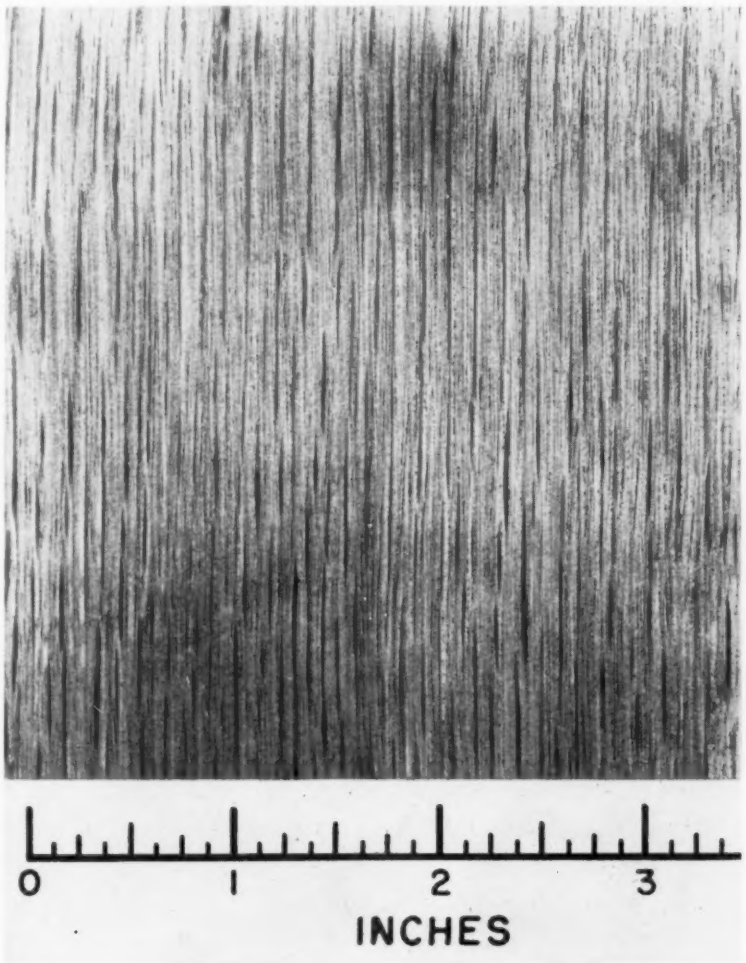

FIG. 6.—Typical rotary-cut tanoak veneer, showing small pores, and resemblance to rift-sawn oak because of almost indistinguishable growth rings.

ular to the grain are given for comparison with the strongest and weakest groups of specimens. The range exhibited by the tanoak specimens tested was similar to that of many species.

In general, the tests showed that the tanoak tested was similar in strength to the oaks commonly used in hardwood lumber production and should be suitable for similar uses.

Suggested Uses

Flooring.—The side hardness of tanoak is similar to that of sugar maple and slightly higher than that of red and white oak which are among our more common flooring species. The hardness, plus its pleasing grain, large ray flecks, and light golden color when finished, should make tanoak an excellent, long-wearing, attractive material for flooring.

Ship and boat construction.—Since tanoak has strength properties similar to red and white oak, is available in long clear lengths, and contains a high proportion of sapwood (60 to 80 percent) that can be treated readily with preservatives, treated tanoak wood should be uniquely suited for ship construction in either the solid or laminated form. One-inch-thick tanoak lumber that was treated with water-borne preservatives is being evaluated at the Puget Sound Naval Shipyard, Bremerton, Washington.

Strap-supported steamed tanoak has been bent without difficulty to forms requiring 25 percent compressibility on the compression side. The static bending tests, in which 60 percent of the green and 72 percent of dry (12 percent moisture content) specimens failed first in compression, are indicative of its suitability for bending.

Railway crossties.—Tanoak crossties have been treated with creosote solutions and are now in main line, railway test tracks of the Southern Pacific Company. Some of these 7- by 9-inch by 8-foot crossties were penetrated completely with the preservative. Since the heartwood is both nondurable and resistant to treatment, incising should be required to obtain the best possible distribution of the preservative.

Furniture.—Uniformity of color, ease of machining, excellent strength properties and ability to take popular finishes suggest the suitability of tanoak for furniture manufacture. Rotary-cut tanoak veneer should be useful in furniture manufacture because of the pleasing grain characteristics, which closely resemble the appearance of rift-sawn oak (Fig. 6).

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Trends in Pine Pulpwood Marketing in the South[1]

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THE GROWTH of the pulpwood industry in the South during the past 15 years has been spectacular in volume of production and in economic value. In 1935, when the pulp and paper industry was beginning its move southward, only slightly more than 2,000,000 cords of pine pulpwood was produced in the entire South. In those days wood brought about $3.50 per cord f.o.b. car. In 1955, over 15,000,000 cords of pine pulpwood were produced in the South. The price now averages about $15 per cord f.o.b. car. From a minor role in the economy of the South, the pulpwood industry has had such a tremendous growth that it is now one of the major contributing factors in the rapid industrial development of the region.

As important as the pulpwood industry is to the entire South, it is even more important to the states of Georgia, Florida, and Alabama. For in these three states is the greatest concentration of pulp-producing mills in the world, and the greatest demand for pulpwood and the largest concentration of pulpwood production. In 1954, in these three states alone, according to U. S. Forest Service statistics, over 6,300,000 cords of pine pulpwood were produced, representing 45 percent of the total amount produced in the entire 12 southern states. It is estimated that in 1955 pine pulpwood production in these three states exceeded 7,000,000 cords.

Naturally, with this tremendous expansion during the past two decades, there have been changes in pulpwood marketing. There have been improvements in harvesting techniques and equipment; improvements in handling and transportation methods; increases in price; and improvements in allied activities, such as public relations, timber conservation, fire prevention and suppression, and the like.

Certain trends are evident as the pulpwood industry continues to grow, five in particular: (1) the seasonal trend in pulpwood production; (2) the growth and spread of field woodyards; (3) the buying of pulpwood by weight; (4) the sawmill waste utilization program; and (5) the increasing demand for pulpwood.

Seasonal Production

The seasonal trend in pulpwood production is a rather serious situation with which the industry will have to reckon in the future.

Since the Southern Pulpwood Conservation Association was formed in 1939, and particularly since World War II, there has been a major effort on the part of the pulpwood industry, other wood-using industries, local and state forestry groups, and the U. S. Forest Service and other governmental agencies to encourage landowners to manage their timberlands wisely. One of the objectives is to encourage woodland owners, especially those with young stands, to thin their trees or make partial cuts so that the remaining timber can grow more rapidly and into higher quality products. This program has achieved increasing success. For example, in lower South Carolina and south Georgia a sizable proportion of the pulpwood is produced under some type of partial cutting operation.

At the same time that landowners began to realize the advantages of selectively cutting their timber they developed a tendency to do such cutting during the winter months when the danger of insect damage would be remote. Following the extreme drought of 1954 through the South, together with the disastrous fire damage in late 1954 and the first half of 1955, the serious outbreaks of insect activity, and the resulting damage to timber, a growing number of land owners insisted that their timber, in the future, be cut only during the winter months. Many small farmer-landowners, on whom the industry depends for the major portion of its stumpage supply, harvest pulpwood during the winter only because they are engaged during the summer with their farming activities. Moreover, as many prefer not to sell timber except when they themselves are able to supervise the cutting, they often wait until the winter to sell, when they have adequate time to handle this business. Finally, with the installation of field woodyards many landowners now use their surplus farm labor during the winter months and produce their own wood.

In former years most pulpwood came from bulk purchases, where the purchaser had a specified length of time, normally a year or two, in which to cut the timber. Thus a purchaser could cut timber at any time during the terms of the lease; and if he so desired he could hold the timber for cutting during the summer. Records indicate that currently almost 50 percent of the pulpwood is bought by the cord. Under this arrangement the purchaser usually has little choice as to the time to cut the timber, his cutting being contingent upon the desire of the landowner.

Many cutting operations now stop when warm weather comes. If this trend continues, the major portion of the wood from private lands may eventually be available for cutting only during the winter months. What will the pulpmills do then for wood during the summer months? How can they be assured of sufficient raw material to carry them from one winter to the next? There are several possible solutions, but each requires

[1]Presented at meeting of Southeast Section, S.A.F., Montgomery, Ala., Jan., 1956.

either a major capital investment or sharply increased operating costs.

One solution would be for a mill to increase its wood supply to perhaps a 60-day level instead of the 20- to 30-day level that most mills now carry, but the mill would then have increased losses from wood deterioration and higher wood rehandling costs. Another solution would be to provide underwater storage to enable the mill to build up sufficient inventory of winter-cut wood to carry it through the summer months without deterioration loss, but this procedure would require a major capital investment and would result in greatly increased handling costs. In addition, a mill could arrange the cutting schedule on its own lands to provide a minimum cut during the winter months when outside stumpage is available and save the major portion of its own stumpage for summer cutting.

Although southern pulpmills are not likely to run out of wood in the summer because of this seasonal trend, the situation poses a serious problem that will receive considerable attention in the industry during the coming years.

Field Woodyards

Another significant trend in pulpwood marketing is the development and growth of field woodyards. During the past two decades, the industry has been striving to reduce the amount of manpower and the manual effort expended in getting pulpwood produced and delivered to the mill. During that period, the cross-cut saw was replaced by wheel and chain saws. In most areas, mules and horses were replaced by tractors.

There are now pulpwood machines that buck up the entire tree and in the same operation carry individual bolts up a small conveyor and load them on trucks. This piece of equipment, however, requires a large-scale operation to make its use profitable, and it is not well adapted to the one-truck operation which is still typical of the pulpwood producing organization in the South.

One of the most highly successful pieces of equipment that is helping increase production and reduce labor costs is the pallet system of loading trucks.

The biggest advance, however, in the trend toward mechanization has been in the development and growth of field woodyards. Woodyards are not new to the South. The system has been used in certain areas and for barge operations for at least twenty years. However, its present application to "railwood" has been in effect only about five years in this area.

The first railwood yard was put in operation in mid-1951. Today, there are approximately 120 yards in operation in our three states. The majority are in Georgia and Alabama, but it is expected that yards will soon be spread over much of Florida also.

A field railwood yard is simply a tract of land, from three to forty acres in size, with a railroad siding located thereon and with mechanized loading equipment to transfer the wood from trucks to cars.

At such locations the wood is paid for on delivery of individual truckloads. The former method was for the producer to load a whole car, ship it to a mill, and then receive payment about two weeks later. Some woodyards are company-operated by a particular mill; others are operated by wood dealers.

The yards have several advantages. They permit the producer to see his wood measured and to see what is accepted and what is culled, a procedure that has resulted in improved wood quality. They provide for on-the-spot payment for wood delivered. They offer the opportunity to the small producer to sell wood in any quantity from one truckload on up, with no worries about demurrage and car shortages. The mechanical unloading of trucks saves the producer much time and enables him to haul more wood per week.

Beside the benefits to the producer, the woodyards have proved advantageous to the mills. In some cases woodyards have brought about decreased costs to a mill, because they have stimulated production in the area served by a yard and at the same time have attracted production which previously went to competitors. The woodyards enable mills to maintain their inventory of stored wood, which in turn permits better control of the flow of wood into their plants, especially during periods of rainy weather when pulpwood production normally falls off. Moreover, during periods of car shortages, field woodyards enable the mills to accept and store wood at the yards whereas previously producers either had to shut down until cars were available or else bank their wood at rail sidings, both of which practices are undesirable and more costly.

To the railroads the yards are desirable because cars are loaded faster, making for quicker turnarounds, and more nearly to maximum capacity, making for more freight revenue per trip. Finally, the woodyards save labor, because they eliminate the two or three laborers per truck that are normally required to unload wood by hand.

Buying Wood by Weight

An increasing number of mills in the South now buy their truckwood by weight rather than by the standard cord. Union Bag & Paper Corporation started buying some of its wood by weight about two years ago. As the loaded truck arrives at the yard, it is driven on the platform of the truck scale and weighed. After it is unloaded, the empty truck is again weighed, the difference of course being the weight of the wood. Culling for nonusable wood is done on a weight basis also. In paying for the wood, the company uses a factor of 5,583 pounds for a weight-unit of pine and 5,934 pounds for a weight-unit of hardwood. The same price is paid for a weight-unit of wood as for a cord bought by volume measurement. Buying by weight has been accepted by the dealer and producer alike as equitable. As scales are open faced, the producer can read the weight, which is electrically printed on the scale ticket. Producers realize that they get paid exactly for the loads on their

trucks. The company has found that buying by weight has a favorable effect on wood quality for the producers trim their wood better to get more volume per load; they haul greener wood to prevent weight loss; and they tend to haul larger diameter wood in order to obtain the advantage of its greater weight.

Buying by weight eliminates the human error in measuring wood. It puts a premium on good, green, well trimmed wood, and discourages the delivery of poorly trimmed and old wood. Moreover, buying by weight is one method of grading pulpwood, which should have grade standards as do other forest products.

Use of Sawmill Waste

The utilization of sawmill waste in the South involves the production primarily of chips from slabs and edgings from debarked saw logs. With keener competition for stumpage and increased demand for pulpwood, more pulpmills are looking to this source of raw material for some of their wood requirements. During the past two years, Union Bag & Paper Corporation has developed its sawmill waste program to the volume of some 400 cords of chips per week.

The equivalent of some 5,000,000 cords of pine pulpwood are contained in the slabs and edgings annually turned out by the sawmills of the South. In 1954, some 80,000 cords of chips were obtained from this source, and it is estimated that during 1955 several times that amount of chips were salvaged from sawmill waste.

The industry is limited, however, in its efforts to step up the utilization of raw material from this source because of the large capital investment and other costs involved in installing and operating log debarking and chipping equipment. Only major sawmills, with large volume production, can be interested in such an installation. What is needed is a more economical and efficient slab debarker. It would permit a tremendous expansion in sawmill waste utilization because small mills would be encouraged to save slabs and edgings for sale to installations having slab debarkers and chippers.

One such debarker, known as the Watkins slab barker, has been put on the market. No doubt, others will be developed.

The pulpwood industry realizes the need for such equipment. Recently, representatives of many of the pulp companies in the South agreed on a program of research to develop a method to separate bark from the wood. The industry also realizes that in expanding this source of raw material it will in effect subsidize its toughest competition for stumpage, the small sawmill operator, but the importance of the conservation aspect of waste utilization far outweighs this factor.

Demand for Pulpwood

There are 27 pulpmills now, or about to be within the next two years, located in Georgia, Florida, and Alabama. During the past two years four new mills began operation; Rome Kraft Company at Rome, Rayonier, Inc. at Jesup, and National Container Corporation at Valdosta, Georgia; and Buckeye Cellulose Corporation at Foley, Florida. In addition, Bowaters Southern Paper Corporation's new mill just over the Georgia line, at Calhoun, Tennessee, went into operation in 1954 and draws a sizable percentage of its wood from both Georgia and Alabama. During the period that these new mills were getting into operation, several others started major expansion programs.

Announcements have been made of three new mills to be built in Alabama: National Container Corporation at Brewton, Gulf States Paper Corporation at Demopolis, and Marathon Corporation at Myrtlewood. Rayonier, Inc. has announced a separate mill to be constructed adjoining the present mill at Jesup, Georgia. International Paper Company is getting ready to put in a new kraft paper machine and newsprint mill at its Mobile plant. Hudson Pulp & Paper Corporation is putting in a tissue machine and is increasing its kraft production at Palatka. Coosa River Newsprint Company is increasing its newsprint and kraft production at Coosa Pines, Alabama. National Gypsum Company at Mobile and Armstrong Cork Company at Macon are enlarging their facilities. Southern Paperboard Corporation and Union Bag & Paper Corporation at Savannah are both making certain improvements which will result in some increased wood consumption. The largest expansion, however, insofar as increased wood requirements are concerned, will be at Jacksonville, where St. Regis Paper Company's mill will install a new 276-inch paper machine to produce at least 1,000 tons of kraft board per day. This one machine will require almost one-half million cords of pine pulpwood annually.

TABLE 1.—ESTIMATED PINE PULPWOOD REQUIREMENTS IN GEORGIA, FORIDA, AND ALABAMA

State	Cords		
	Present	*Expansion*	*Total*
Georgia	3,235,000	440,000	3,675,000
Florida	3,250,000	650,000	3,900,000
Alabama	1,175,000	1,050,000	2,225,000
Total	7,660,000	2,140,000	9,800,000

After all this expansion is completed, how much pine pulpwood will be required to supply the needs of the mills in the three states? According to the most reliable information available, the requirements are shown in Table 1.

Where will all this additional wood come from and how will this increased demand affect the marketing of pulpwood? We can expect a sizable increase in the amount of wood salvaged from sawmill waste. Additional wood will, no doubt, be cut from lands owned by the various paper companies, but most of those lands are still some years from maximum productivity. Thus, the bulk of this increased wood requirement will have to come from private landowners who own approximately 75 percent of the 66,000,000 acres of forest in the three states. Obviously, competition for timber will be keen.

The increased demand for pulpwood will create markets wherever pine timber grows. And where markets are created and as demand in-

creases, the growth rate of the timber in those areas should increase. However, growth is not nearly fast enough and few landowners have put their timberlands under intensive management. But under intensive management the present growth rate of pine in the South could be more than doubled, and that additional growth would be more than sufficient to meet the anticipated needs of our wood-using industries in the foreseeable future.

To sum up, the problem in general is not to find a market for pine pulpwood, but to find the raw material to be marketed.

Opening Case-Hardened Southern Pine Cones

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THE RECENT expansion in nursery production of slash and loblolly pines in the South has greatly increased the demand for seed. When several agencies are attempting to collect cones in the same area in a year when cones are scarce, an intense competition develops for available cones. Even when seed extracting agencies postpone buying cones until they are ripe, pickers tend to collect and stockpile cones two or three weeks ahead of time. Buyers have been reluctant to refuse such immature cones for fear of losing important sources of a scarce crop. This study was initiated to determine possible means of reclaiming seed from immature cones which case-harden in the extraction process.

Ordinarily, cones open as a direct function of water loss. Any treatment which hastens evaporation will increase the rate of opening. Opening is accomplished by the differential drying of tissues at the base of the bracts.

Wakeley[2] has suggested that some slash pine seeds mature before the cones have reached a specific gravity of .89. Although such seeds when dry will have the endosperm shrunken away from the seed coat, some will germinate and produce normal seedlings. Seeds from three immature cone lots from the 1954 season in Georgia gave germination percentages of 55, 79, and 85. Maki (*4*) found that ponderosa pine seeds collected late in the season germinated better than immature seeds, and Barton[3] found only 25 percent of embryos from immature loblolly cones capable of germination.

Drying immature cones by heat will cause them to case-harden. The bracts become cemented closed and fail to open even after prolonged drying. Wakeley (*11*) has shown that cones with a specific gravity greater than .89 when heated to 120 degrees F. do not open well but that many of the cones will open if they are precured at 70 to 90 degrees for several weeks before heating. He has advocated flotation in SAE 20 motor oil as a criterion for maturity of cones. Cones which float in oil will open immediately on drying.

When case-hardening occurs, the opening mechanism will not operate. No extensive work has been done to determine the nature of case-hardening. Romell (*10*) theorized that rapid drying of the surface sealed the tissues and prevented internal drying. He believed the process to be similar to that which causes the splitting of lumber when dried too rapidly. He postulated that the heat coagulated colloids on the bracts and reduced vapor pressure at their surface.

Literature on cone-opening states that a precuring process is necessary to open white pine cones (*6, 7, 9*) and is advised also for lodgepole (*1*) and Scotch pine (*12*). Such opinions may have developed because of case-hardening or because heating seed in the kilns while the moisture content is high reduces germination (*3, 5, 7*). Rietz and Kimball (*8*) have shown that precuring is not necessary for opening red pine cones.

In the past, case-hardened pine cones have been opened by dipping them in water (*2*) or in the case of jack pine, heating to 140 degrees (*7*).

Experimental Methods and Results

Slash pine cones collected August 25, 1954, while the specific gravity was still above .89, were placed in heated cone sheds. Temperatures were gradually increased for the first 10 days from 85 to 105 degrees F. and then maintained at 105 degrees for 10 more days. At the end of the heating period, less than 20 percent of the cones had opened, although their moisture content was well below that of cones that had opened normally. If the cones were rolled under foot on a concrete floor, the bracts could be split apart at the outer edge but the cones still would not open. If

[1] Many of the seed germination tests were run by S. J. Johnson and associates, of the U. S. Forest Service Region 8 Seed Laboratory.

[2] Personal communication with the author.

[3] Letter to P. C. Wakeley, U. S. Forest Service, Southern Forest Expt. Sta., New Orleans, Louisiana.

cones which had been mechanically rolled were then dipped in water, they could be opened by subsequent drying. Experiments with different water temperatures showed that 160 degrees for 15 minutes or more injured the seed, while those dipped at 80 degrees and 122 degrees were uninjured. The minimum immersion time for these lower temperature dips was one hour. Rolled cones opened satisfactorily with this minimum dip at either of the temperatures.

Dry heat at 140 degrees recommended for jack pine failed to open the cones even after they were dipped in ice water while still hot. Curing cones at alternating temperatures of 105 degrees in the day and 40 degrees at night was suggested as a substitute for mechanical rolling. Such treatment failed to open the cones, and in addition caused some injury to the seeds.

In order to determine the minimum length of dip necessary to open rolled cones, an experiment was set up in which cones were sprinkled once, sprinkled daily for 7 days, and dipped for 1, 5, 20, and 60 minutes in water at 80 degrees F. There were 5 replicates of 16 cones each for each treatment. After 2 weeks at 105 degrees F., records on cone-opening were taken and seeds extracted. The results are shown in Table 1.

The data indicate that sprinkling was as effective as any of the dips. Daily sprinkling slowed the rate of opening, presumably by increasing the water content of the cones.

In another experiment using immature loblolly cones, 10 lots of 32 cones each were rolled by moving endless canvas belts which forced the cones between cylinders pressed together by spring tension. A similar group was left unrolled. These cones had not been subjected to any preheating. The mechanical rolling permitted the cones to open and increased the rate of drying and the yield of seed without significant injury. The results are presented in Table 2.

TABLE 1.—EFFECT OF WATER TREATMENT OF CASE-HARDENED SLASH PINE CONES WHICH HAD BEEN ROLLED TO LOOSEN THE BRACTS

Treatment	Cone opening index[1]	Seed yield	Germination[2]
		Grams	*Percent*
No water	0	0	—
Sprinkled once	5	94	55
Sprinkled daily, 7 days	2	79	74
Dipped 1 minute	4	86	73
Dipped 5 minutes	5	96	56
Dipped 20 minutes	7	113	79
Dipped 60 minutes	6	98	70
Least significant difference 19:1	2	—	19

[1]An arbitrary rating determined by number of cones, out of 16, with bracts completely open at the end of treatment.
[2]Determined by greenhouse tests in soil. Not corrected for unfilled seed.

TABLE 2.—EFFECT OF MECHANICAL ROLLING ON THE OPENING OF IMMATURE LOBLOLLY PINE CONES

Treatment	Cone opening index[1]	Water loss	Seed yield	Germination[2]
		Percent	*Grams*	*Percent*
Rolled	17	39	28	80
Unrolled	6	30	12	85
Least significant difference 19:1	3	1	—	—

[1]An arbitrary rating determined by number of cones, out of 32, with bracts completely open.
[2]Determined by laboratory tests in sand and corrected for unfilled seed.

Discussion and Conclusion

Although the specific gravity test for determining maturity of slash and loblolly pine cones works satisfactorily and is generally used, local conditions sometimes cause immature cones to be collected. Some of the seed from such cones can be reclaimed if they are mechanically rolled. If drying has removed water from the cones to such an extent that the opening mechanism no longer operates, sprinkling them with water after they have been rolled will often reactivate the mechanism. Although it is not recommended that such cones be collected, there may be some circumstances under which knowledge of means of reclaiming the seed will be valuable.

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Notes

Air Movement Under an Aspen Forest and on an Adjacent Opening

Anemometer measurements of air movement were obtained under an aspen (*Populus tremuloides*) forest and from an opening in the aspen forest stand on lands in the head of Parrish Canyon, Davis County Experimental Watershed near Farmington, Utah, during the summer of 1948. These records were obtained in conjunction with a study reported by Croft and Monninger[1], but were not utilized or published in their report.

One record was obtained from an anemometer placed about 2 feet above the ground surface in a thick stand of gnarly aspen. The aspen stand contained about 3,000 stems per acre. The trees averaged about 12 feet in height and ranged from 1 to 6 inches d.b.h. There was an understory of broadleaf plants and grasses having a density of about 40 percent and a maximum height of 20 inches. The anemometer was thus above the herbaceous understory and below the tree canopy.

Another anemometer was placed in the lower third of a rectangular opening in the aspen forest about 70 × 200 feet in size. The open area had an herbaceous plant cover similar to that under the adjacent aspen forest. The anemometer was placed at a similar distance above the ground surface and the herbaceous plant cover as the instrument under the aspen but at a horizontal distance of at least 30 feet from the nearest aspen tree.

Both anemometer sites were at elevation 8,200 feet on a southwest aspect having a ground slope of 19 percent. Both were fully exposed to the prevailing westerly winds.

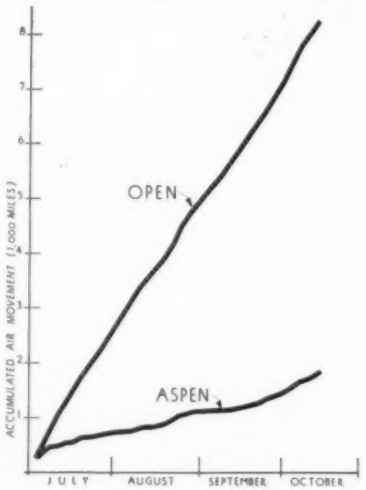

FIG. 1.—Air movement under an aspen forest and in an aspen forest opening; Parrish Canyon, Davis County, Utah. Elevation 8,200 feet. 1948.

A total of 83 readings were made on each anemometer during a 105-day period from July 1 to October 13. Most of the readings were made at 24-hour intervals, but at the beginning and toward the end of the study as well as on weekends and holidays, the intervals between readings varied from 48 to 72 hours.

Total air movement for the season under the aspen cover was 1,799 miles. It was 4.57 times that much, or 8,226 miles in the open (Fig. 1).

The greatest daily difference in air movement occurred on September 9 when it was 74 times greater in the open than under the aspen. During the main part of the season, July 7 to October 1, air movement was 6.36 times greater in the open than under the aspen. In early spring when the aspen leaves were not fully developed, air movement averaged from 1.4 to 2.0 times greater in the open. Air movement averaged around 3 times greater in the open late in the fall after aspen leafcast.

Air velocities for the season as a whole averaged 3.29 m.p.h. in the open and 0.72 m.p.h. under the aspen (Table 1). These velocities are in fair agreement with those measured at Wagon Wheel Gap, Colorado.[2]

The aspen cover reduced air velocities by an average of 2.57 m.p.h. for the entire season. For individual pairs of readings during the main part of the season, the reductions varied from 1.76 to 4.10 m.p.h. These reductions in actual velocity were directly and highly correlated with velocities in the open (Fig. 2, A). This is in agreement with the conclusion drawn by Kittredge[3] that, "The reduction of actual velocities in the canopies and below it is greater in strong than in light winds."

The relative reduction in wind velocity under the aspen was 78 percent for the entire period. The reduction for individual pairs of observations during the main part of the season varied from 51 to 98 percent. These reductions were in-

TABLE 1.—AVERAGE AIR VELOCITIES UNDER ASPEN FOREST COVER AND IN THE OPEN, PARRISH CANYON, DAVIS COUNTY EXPERIMENTAL WATERSHED, 1948

	Velocities		Reductions	
	Open	Aspen	Actual	Relative
	M.p.h.	*M.p.h.*	*M.p.h.*	*Percent*
July	3.62	1.00	2.62	72
August	3.11	0.54	2.57	83
September	3.02	0.44	2.58	85
October (1-13)	3.61	1.15	2.46	68
Main Season (7/7-10/1)	3.16	0.51	2.65	84
Entire season (7/1-10/13)	3.29	0.72	2.57	78

[1]Croft, A. R. and L. V. Monninger Evaporation and other water losses on some aspen forest types in relation to water available for streamflow. Amer. Geophys. Union 34(4):563-574. 1953.

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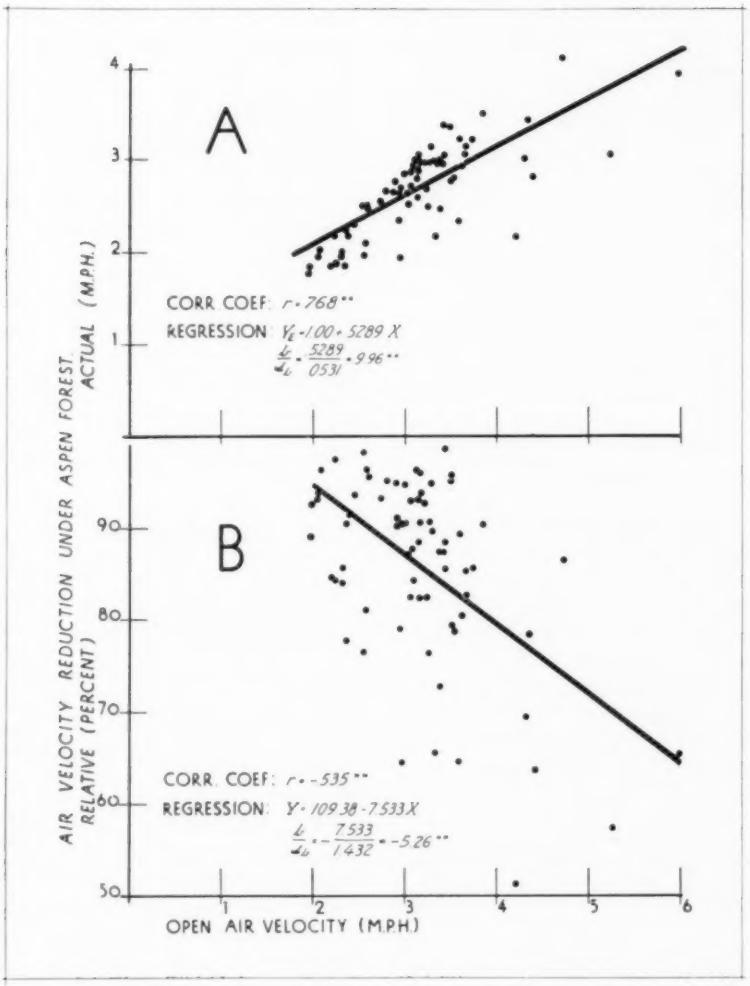

FIG. 2.—Relation of actual (A) and relative (B) reduction of air velocities under aspen to velocities in the open; Parrish Canyon, Davis County Experimental Watershed, Utah. 1948.

versely and highly correlated with velocities in the open (Fig. 2, B). This is not in agreement with the second part of Kittredge's conclusion that, "The relative reduction varies little with velocity." A possible explanation for this disagreement is the lack of high velocities during the period of record. None of the velocities recorded during the study exceeded 6 m.p.h.

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U. S. lumber manufacturers produced a record-breaking 39,105,000,000 board feet of lumber during 1955, according to estimates of the National Lumber Manufacturers Association. The 1955 volume was seven percent above 1954 and exceeded output for each of the 26 preceding years during which comparable records have been maintained. Softwood production in 1955 was eight percent above 1954, while output of hardwoods increased one percent.

Preplanting Dip for Controlling Pales Weevil[1]

In limited tests in east Texas, dipping pine planting stock in dilute benzene hexachloride suspensions has reduced damage from the pales weevil, *Hylobius pales* (Hbst.). This weevil often is a serious pest when pine seedlings are planted where older pines have recently been cut.[2]

In the winter of 1954-55, nine treatments were applied to 1-0 loblolly seedlings that were then planted on 8 plots in an area where pines had recently been cut and hardwoods girdled. Within each plot, 9 rows of 10 seedlings each were planted. Treatments were randomly assigned to the individual rows.

Six treatments involved dipping the tops or the tops and roots of seedlings in water suspensions of benzene hexachloride (BHC) at concentrations of 0.05 percent, 0.1 percent, and 0.2 percent of the gamma isomer. A commercial spreader-sticker was added to each of these suspensions at the rate of 18 drops per 3 gallons of water. Two additional treatments were top dips and total dips in the spreader-sticker without BHC. The ninth group of seedlings was untreated. Half of the plots were planted on December 22, 1954, and half on February 17, 1955. Freshly lifted stock was used on each date. The seedlings were dipped just before being planted. All 9 treatments were also replicated on 6 plots (3 installed at each planting date) in an old field, where no weevils were present.

The significance of the resulting data was tested by analysis of variance.

Weevil Attack and Mortality

As of September 30, 1955, seedlings treated with 0.1 or 0.2 per-

[1]The study was made at the East Texas Research Center, which is maintained at Nacogdoches, Texas, by the Southern Forest Experiment Station in cooperation with Stephen F. Austin State College.

[2]Recent observations indicate that two related species, *Pissodes nemorensis* Germ. and *Pachylobius picivorus* Germ., may be responsible for some of this damage.

TABLE 1.—INCIDENCE OF WEEVIL ATTACK AND MORTALITY ATTRIBUTABLE TO WEEVIL DAMAGE AT THE END OF THE GROWING SEASON (SEPTEMBER 30, 1955)

Treatments	Seedlings attacked	Seedlings dead	Attacked seedlings dead
	Percent		
BHC and spreader-sticker			
0.05 percent top dip	54	16	30
0.05 percent total dip	58	16	28
0.1 percent top dip	45	22	50
0.1 percent total dip	31	16	52
0.2 percent top dip	25	9	35
0.2 percent total dip	32	15	46
Average for BHC	40	16	39
No BHC			
Spreader-sticker top dip	49	35	74
Spreader-sticker total dip	55	48	86
Check	60	44	81
Average for no BHC	55	44	80

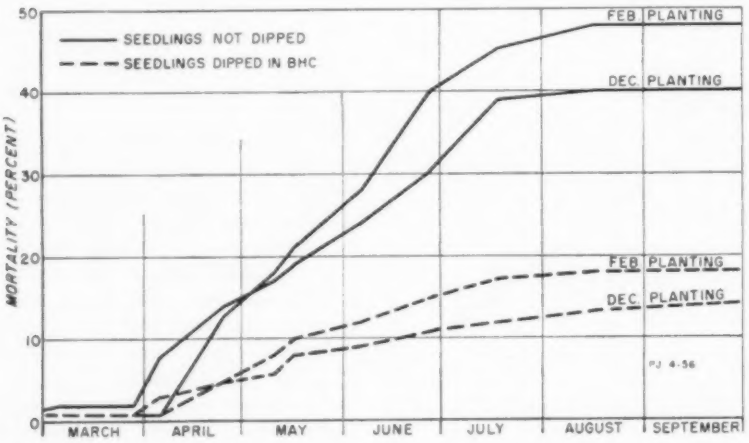

FIG. 1.—Cumulative mortality from weevil attack on loblolly pines. Nacogdoches, Texas, 1955.

cent gamma BHC had suffered significantly less attack (38 and 28 percent) than had untreated seedlings (55 percent). The 0.05-percent concentration caused no apparent reduction in attack (Table 1).

Mortality for all BHC-treated seedlings averaged 16 percent significantly below the 44 percent mortality for those not treated with the insecticide. Differences between concentrations of BHC, and between top and total dips, were not statistically significant.

As the last column of Table 1 makes clear, BHC was even more effective in reducing the mortality of attacked seedlings than it was in preventing attack. Eighty percent of the untreated seedlings, but only 39 percent of the treated ones, died after attack. The differences are highly significant. Evidently the insecticide, including the 0.05 percent concentration, killed or repelled many weevils before they had girdled the seedlings.

As Figure 1 indicates, virtually all mortality occurred between the first of April and the end of July. (The same pattern of mortality was also observed in 1954, on untreated seedlings planted on similar sites.) Both the December and the February dips reduced losses throughout this period, and both seemed about equally effective.

The plantings in the open field tested whether the chemical dips harmed the seedlings. On this severe site about 40 percent of the seedlings died before September, but mortality was no higher for those dipped in BHC than for those not exposed to the chemical. Where roots as well as tops were dipped, mortality was higher than where only tops were dipped, but the difference was not statistically significant.

Recommendations

While further study is desirable to determine optimum concentrations of BHC, or possibly an alternative insecticide or vehicle, these tests warrant use of a 0.2-percent BHC water suspension as a top dip for pine seedlings to be planted on areas from which pine has recently been cut. Such a dip can be applied at a few cents per thousand seedlings and should greatly improve survival where weevil populations are high.

The BHC suspension must be constantly agitated to insure a uniform deposit of the insecticide on the seedlings. Wettable BHC irritates the skin of some individuals and may make it necessary for them to wear rubber gloves while handling treated pines. The chemical is poisonous. Planting crews should be cautioned to wash their hands carefully before smoking or eating.

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Annual Meeting Issue

The editorial content of the October issue of the JOURNAL OF FORESTRY, the month of the annual meeting in Memphis, Tenn., will be devoted to forestry in the South. Articles in this issue will be of special interest to foresters attending this meeting, for they will contain a wealth of information that will make more meaningful the meeting's theme: "Forestry Faces Forward."

Topophysis and Other Influences on Growth of Cuttings From Black Cottonwood and Carolina Poplar[1]

Vegetative propagation by cuttings is used widely to reproduce individual plants that possess desirable characteristics. In long-lived plants such as trees the question of which portions should be removed to produce the best offspring must be considered, even though in theory the cells in all portions of a clone have identical gene complements. The importance of position of cutting within the plant was emphasized by Molisch (*4*). He proposed a term "topophysis" to describe the tendency of cuttings to retain temporarily or permanently some of the morphological and growth characteristics of the position from which they were taken in the parent tree. This tendency was discussed by Mirov (*2, 3*).

After visiting some European poplar plantations, John Bene, president of Western Plywood Company Limited, mentioned the emphasis placed by German silviculturists on securing cuttings from leader wood. This remark aroused the interest of the authors in making a test of topophysis and other factors. In consequence, influence of species, age, length, diameter, depth of planting, and position of cutting (topophysis) were investigated in a greenhouse experiment during the spring of 1955.

Procedure

On February 11, 1955, 48 cuttings were taken from a 7-year-old Carolina poplar (*Populus canadensis* var. *eugenei* Simon-Louis) and the same number of cuttings were removed from a three-year-old black cottonwood (*Populus trichocarpa* Torr. & Gray). Both trees were growing on an upland situation at rates equivalent to German site II (*1*). Equal numbers of cuttings were taken from one- and two-year-old wood growing in each of three positions: leader, first primary branches adjacent to the leader, and secondary branches from these first primary branches. Two lengths of cuttings, 3 and 6 inches, were also tested as a main factor.

The basic unit was a 12 x 12 inch plot containing two similar cuttings of Carolina poplar and two of black cottonwood at a spacing of 8 by 8 inches. Each species pair was set at diagonally opposite corners of the square, the species being allotted randomly to the diagonals in each square. The factors of position, age, length of cutting, and depth of planting were allotted randomly to the basic units within a greenhouse bed 4 feet wide and 12 feet long. The plots occupied the central 3 by 8 foot portion with a minimum 6 inch margin all around to reduce the effect of the retaining walls of the bed. The rooting medium was a five-inch deep mixture of peat moss, sand, and cinders. Depth of planting was controlled by exposure of either 20 or 40 percent of the total length of each cutting. All cuttings were soaked for 20 minutes in a solution of a commercial fungicide prior to planting.

The cuttings were watered daily at first, then twice weekly until the experiment was terminated in July. Growth of cuttings was not luxuriant because of the poor nutritional quality of the medium and partial defoliation by leaf-rolling insects. The insects attacked all cuttings but were controlled eventually by liberal dustings with DDT and derris powder.

Initial diameter of cuttings and periodic measurements of height growth were taken and analysed in some detail.

Observations

Although all rates of growth were slow, relative differences were sufficient to indicate importance of factors. An analysis of variance of total-height growth indicated that the main factors, excepting depth of planting, were significant at the 5 percent level. Black cottonwood growth averaged 16 inches—four times that of the average Carolina poplar. Cuttings of both species taken from leaders grew 12 inches on the average; those taken from primary branches next to the leader grew 8 inches on the average; and those cuttings taken from secondary branches grew only 4.5 inches on the average. One-year-old wood grew 11.8 inches in comparison with two-year-old wood which averaged 8.3 inches. Six-inch cuttings grew 4.2 inches more than the average of cuttings that were initially three inches long. Doubling the length of cutting increased height growth by 56 percent.

There was little difference between one- and two-year-old cuttings of Carolina poplar. One-year-old black cottonwood cuttings, however, grew 7.1 inches more and significantly faster than the average of cuttings from two-year-old wood. Another relationship of considerable importance became evident when the effects of position, age, and species were compared. Both one- and two-year-old leader-wood of Carolina poplar and of black cottonwood grew rapidly. Although one-year-old primary side branches of black cottonwood grew just as fast as the leader wood, primary side branches of Carolina poplar grew at a rate that was significantly slower than that of leader wood. This may perhaps be explained by the fact that the Carolina poplar tree was four years older and much taller than the black cottonwood. Position, age, and species effects are illustrated by the following table.

	Leader		Side	
	1-yr.	2-yr.	1-yr.	2-yr.
	(Avg. height growth in in.)			
Carolina poplar	4.8	5.0	2.9	3.0
Black cottonw'd	18.6	19.5	20.7	5.8

Regressions of height growth on initial diameter of cutting were calculated and tested for Carolina poplar, black cottonwood, and the combination of both species but initial diameter of cutting had no significant effect on height growth.

The vigor of two-year-old secondary branches of Carolina poplar was slight. Only three of eight cut-

[1]Research Note No. 10, Faculty of Forestry, The University of British Columbia.

tings survived and these three grew less than half an inch during the period of observation. Two-year-old secondary branches of black cottonwood were not available for comparison.

Conclusions

1. Position in the crown from which cuttings are taken has an important influence on both height growth and survival of cuttings. It would probably be of even greater importance if cuttings were taken from mature trees.

2. In general, longer cuttings of one-year-old leader wood are preferable.

3. Cuttings taken from one-year-old side wood and both one- and two-year-old leader wood of a vigorous three-year-old black cottonwood may be expected to grow at substantially the same rate. This may be attributed to the great vigor of all parts of such trees when very young.

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J. H. G. SMITH, P. G. HADDOCK and W. V. HANCOCK
Respectively assistant professor, associate professor, and graduate student in the Faculty of Forestry of The University of British Columbia, Vancouver, B. C.

Notes on Forestry Research In Yugoslavia

In 1951 and 1952 the JOURNAL OF FORESTRY reviewed several Yugoslavian forest research activities. Mention was made that more attention might be paid to research work done in the forestry colleges of Yugoslavia.

Recently the Wisconsin College of Agriculture received the research volumes for 1951-1954 from the University of Belgrade College of Forestry. A brief bibliography of the research work may be of interest to workers in America.

The Forestry College staff in Belgrade should be complimented for their efficient forestry research program. We are happy to exchange information with them.

Forest Entomology

Dr. Svetislav Zivojinolic reports on the results of investigations on *Scolytidae* in the Maljen mountain region (Vol. 8, 1954). Many members of this insect family are included with accompanying large illustrative material.

Wood Utilization

Dr. Milutin Knezevic reviews his work done in the field of utilization. In the paper "Sawing a Log into Boards of Equal Thickness for Best Quantitative Utilization" the writer presents his method for determining the optimum uniform thickness of boards. Tables are included (Vol. 8, 1954). Work of Dr. Knezevic was reviewed in the March, 1951 issue of the JOURNAL OF FORESTRY. More recent research includes "Sawing for Maximum Quantitative Utilization" (Vol. 4, 1952) and "The Graphics of Sawing for Maximum Quantitative Utilization of Logs" (Vol. 6, 1953).

Wood Anatomy

Differences in the microscopic structure of wood among certain species of the genus *Acer* is reported by Dr. Svetislav Vasiljevic. This work would be of interest primarily to wood technologists. Dr. Vasiljevik's early research on the genus *Acer* was reviewed in the JOURNAL OF FORESTRY in 1950 (Vol. 8, 1954).

Forest Ecology and Forest Soils

Dr. Toma Bunusevac reviews research work done with Michailo Antic on "The Chemical Reaction of Soil in Forest Associations of the Majdanpek State Experiment Farm" and "The Ecology of Ground Cover of the Forest Association of Serbia" (Vol. 5, 1952). In Vol. 3, 1951, Dr. Bunusevac made a report on the "Geological Base and the Distribution of Forest Associations on the Majdanpek Experiment Station and Vicinity." Numerous photos and tables accompanying the research data make these papers an outstanding contribution to Yugoslavian studies.

Dr. Bunusevac and Michailo Antic also review their ecologic study on "The Influence of Some Forest Types on Edaphon (soil life larger than bacteria) Conditions of Delibat Pescara" (Vol. 3, 1951).

Of interest is the research work of E. Vukicevic-Ilic "The Vegetation and Soil of Burned Areas in the Majdanpek Region" (Vol. 7, 1954). Phytozenologic studies and soil tests were made on this area as early as 1928 and 1946. The comparison of soil profiles is made of burned and unburned areas.

Forest Management

Dr. Zarko Miletic reviews management problems in beech stands. Research work on a virgin beech stand is reported by Zivojin Milin (Vol. 7, 1954).

Forest Chemistry

Sinisa Stankovic and co-writers report on the "Quantitative Annual Changes of Essential Oil, Carotene, and 1-ascorbic Acid in Needles of *Pinus sylvestris* and *Pinus nigra*" (Vol. 8, 1954). Related work is also reviewed in Vol. 5, 1952 and Vol. 6, 1953.

Forest Botany

Milovan Gajic reports on the plant cover of Kosutniak (Vol. 5, 1952).

Silviculture

Research on crown form and volume of *Fraxinus excelsior* stands in the provincial forests of Srem is reported by Dragimir Milojkovic. This study involves an adaptation of the Schwappach method to local Yugoslavian forest conditions. He presents accompanying tables (Vol. 6, 1953).

Individual volumes may be secured from the Uninversity of Belgrade, College of Forestry Library, Belgrade, Yugoslavia. The college is interested in exchanging forest research publications.

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Points of View

Standardized Values by Scribner Rule for Small Logs Needed

A problem has arisen in the use of the Scribner Log Rule in this locality. How far this problem extends is not known. It seems that there are at least two log rule manufacturers selling commercial Scribner log sticks through local hardware dealers.

Table 1 shows a comparison of the various interpretations in existence of the Scribner log rule from 6 to 11 inches.

As can be seen from the comparison, a considerable discrepancy exists. Foresters who use tree volume tables based on items in Column 3 will find that when the timber is sold and scaled with the values shown in Column 1, there will be a considerable difference in total volumes. So much of our timber is in the small diameter range, that the difference can be of a very important magnitude.

The original Scribner rule did not have values for logs smaller than 12 inches. Since that time there seem to have been various and unrelated attempts to develop these values.

I believe that the Society of American Foresters should publicize these variations so that all foresters will know of these discrepancies. In addition, I believe the Society should take steps to develop uniform values acceptable to public agencies, industry, and private foresters.

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TABLE 1.—COMPARISON OF SCRIBNER LOG RULES BOARD FOOT CONTENTS FOR 16 FOOT LOGS

Dia. small end of log	Comm. Log Scale Sticks[1]	U.S.F.S. Scribner Dec. C[2]	Values used in constructing volume tables[3]	Values on tree and log stick[4]
6	9	2	12	18
7	16	3	21	28
8	25	3	30	32
9	36	4	42	40
10	49	6	55	50
11	64	7	70	65

[1]Sold in local hardware stores in South. Manufactured by Lufkin rule and others.
[2]From National Forest Scaling Handbook.
[3]Values used in constructing tree volume tables as found in "Tables for Estimating Board-Foot Volume of Timber," U.S.F.S. Mesavage and Girard and "Volume Tables, Converting Factors, and Other Information Applicable to Commercial Timber in the South" R-8-U.S.F.S. Obtained by formula $V=0.79D^2-(2D+4)$ Table 46, p. 155 "Timber Cruising" by J. W. Girard and S. R. Gevorkiantz, U.S.F.S. Oct. 1939.
[4]Log values on tree and log scale stick sold commercially and developed by R-9 U.S.F.S. about 1940. Values taken from "Timber Cruising" page 153, Table 44, Girard & Gevorkiantz, U.S.F.S. Oct. 1939.

Genetics or Exotics?

One reads more and more articles about research in the selection and improvement of our native species and less and less about the trials of exotics. Our objective is to produce the maximum amount of the desired types of wood per acre per year. Can this be more economically achieved through improved indigenous species or through exotics that are better suited for the specific objectives and sites?

The experience of the writer in Chile, where every species recommended at the present by foresters for large-scale planting is an exotic, has caused him to make an observation that he would like to present here. It could very well happen, that after valuable time and resources have been spent in the United States developing hybrids and selecting strains of our native species, that exotics will be found that will produce more and better wood than the improved indigenous species. How can we be sure that we are working with the right trees? It seems that the approach should be to try all the species in the world that might thrive in a particular area in order to find the trees best suited for it—then begin hybridizing and selecting.

At this stage, perhaps the greatest possibilities for advancement in forestry lie in the selection of the best species for given sites. There are 1.4 million acres of Monterey pine planted in Chile, South Africa, New Zealand, and Australia. In Europe exotics make up an integral part of planting and are becoming increasingly important. The variety and quantity of fruits, vegetables, and meat on our tables would be much less if the agronomists, horticulturists, and animal husbandrymen had limited themselves to native species. In this respect we must be some two to three hundred years behind agriculture.

A large experimental program with exotics is needed to find the best species for future planting in America. It could be that the best tree for Chatham County, North Carolina is a tree from Japan or Australia rather than loblolly pine.

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Plan now to attend the Society's annual meeting in Memphis, Tenn., October 14-17. See page 479.

Reviews

The Gray Squirrel: Its Life History, Ecology and Population Characteristics in West Virginia

By Hans G. Uhlig, 175 pp. Conservation Commission of West Virginia, Charleston. 1955.

All too infrequently a study of a particular game species is so reported as to furnish the practicing forester with management details which can be converted into field operations.

Hans Uhlig has accomplished this in his approach to *The Gray Squirrel*. While wildlife biologists may question Uhlig's findings as to length of season and bag limits, nevertheless his descriptions of habitat requirements are sound and can well serve as a firm basis for coordinated squirrel and forest management.

I am sure the forester will be happy to see just what constitutes a "den" tree. Since the gray squirrel is a native of oak-mixed hardwood types, I can find no controversy with good forest practice as the major stands of this type are being managed for sawlogs and veneer. According to Uhlig, a "den" tree may be considered to be a white oak, over 15" d.b.h. thrifty and well crowned. Leaving 2 to 5 such trees per acre constitutes good silviculture, certainly a basal area of 6 sq. ft. per acre is a good investment in growing stock.

Uhlig finds that gray squirrels consume about one and a half pounds of food per week and based on average acorn production 5 to 8 oaks, sawlog size are required to keep one squirrel for 34 weeks (September through April). A close study of the publication will reveal additional management information such as this that the forester can apply in marking timber for harvest and planning for the future.

In this day of interest in hickory, as evidenced by the hickory task force report and financial maturity as a basis for selecting desirable growing stock, in hardwood stands, I cannot see that too much change in silviculture is required to satisfy the habitat requiremnts of the gray squirrel.

I recommend highly Uhlig's *Gray Squirrel* to foresters who are managing hardwood and have an interest, even passive, in wildlife management.

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The Singing Wilderness

By Sigurd F. Olson. 245 pp. Illus. Alfred A. Knopf, New York, N. Y. 1956. $4.

Not a book to be read at one sitting *The Singing Wilderness* should be rationed like water to a desert traveler. To appreciate it to the full, one must pause for long moments of contemplation over many of its passages. It must be sipped, not gulped.

Each of its 33 prose poems is a delicately etched vignette which sings as it unfolds the spirit and beauty of the "rugged wilderness of rivers and lakes and forests" lying astride the Canadian border between Lake Superior and Lake of the Woods.

These poetical and philosophical interpretations are written by a sensitive man who has lived in and has intimately known wilderness country through all the seasons for 35 years. Here is no arm chair naturalist. From the days when maps were mere sketches, Sig Olson has guided canoe parties and wended his solitary way through the maze of wilderness lakes in this land of the *voyageur*. He knows the snowshoe trails as well as the waterways. "Ten thousand tea sticks mark his trail."

A rare combination of the doer and the sayer, he has caught the serene soul of the country as well as its beauty and in *The Singing Wilderness* he expresses both in a way that touches the quick. Inevitably, his style bears a strong flavor of Thoreau—not surprising for one who worships at the same shrine before which the sage of Concord bowed in reverence.

This author is not content merely to describe, he probes for meanings that give the reader a more revealing attitude toward the out-of-doors and a deeper sense of eternal values. He deals with man's need for the healing peace and quiet of the wilderness and with his longing to be in harmony with his environment. One senses the vital importance of the ancient and essential relationship of mankind to all forms of life, the feeling that the wilderness is an organic whole in which everything from lichens to men is ecologically interdependent and in timeless rhythm.

Sig Olson is dedicated to the preservation of wilderness everywhere but especially the famous Quetico-Superior country. He has been in every battle to preserve it. He has written and lectured extensively, building up appreciation of the wilderness concept. At the moment he is president of the National Park Association, wilderness ecologist of the Izaak Walton League of America, and consultant to President Eisenhower's Quetico-Superior Committee.

Knopf has done a superb job in the book itself; the jacket, the cover, the choice of type and paper, and the spectacularly beautiful black and white sketches by Francis Lee Jaques who, more than any other artist, has the feel of this wilderness lake country.

Written with warmth, clarity, and good humor, in a style disarmingly simple, this is a book not only for those who know the bite of the

tump line on the portage, but for all who would capture the joy of wilderness living and the deeper meaning of this last unexploited lake region in the center of our continent.

F. B. HUBACHEK
Chicago, Ill.

What Wood is That?

By Alfred Schwankl. 164 pp. Illus. Studio-Crowell, New York, N. Y. 1956. $6.50.

H. L. Edlin, a well-known British forester, has translated this interesting publication from German. It is written for the woodworker and the student, and is intended to enable one to identify the most important commercial woods used in Britain and Europe.

Actually, the species described in the keys include timber trees of Europe, North America, and the temperate regions of Asia, together with some native to the tropics. In addition to the 150 illustrations and diagrams, there are 40 actual wood specimens, thin strips of veneer, mounted on cards and labeled by name.

As a regular guide to the 40 specimens illustrated by samples, the book appears to be both practical and helpful. In order to identify other species, the key must be used. In this respect, the publication does not differ greatly from the conventional textbook or wood identification.

The translator has happily assisted the reader with the always complicated problem of nomenclature. Edlin has used not only the usual trade names, German names, and scientific names, but he has included the names British and American foresters customarily employ.

Any one concerned with wood, whether amateur or technologist, will find this little publication of more than casual interest.

HENRY CLEPPER

Publications of Interest

The Boy Scouts of America have issued a new revision of their merit badge pamphlet, *Forestry,* written by the U. S. Forest Service and reviewed by American Forest Products Industries, Inc. In addition to supplying information necessary to the Scout for meeting his merit badge requirements a short section gives vocational information for those interested in considering forestry as a career.

* * *

Technical Skills Needed by Teachers of Vocational Agriculture covers for seven agricultural subjects, including forestry, a list of technical skills required for effective teaching, indicates the extent to which different skills were used by teachers in actual practice and the value placed on these skills by the teachers. Results of a study sponsored by the Teacher Training Committee of the North Atlantic Regional Conference for Supervisors and Teacher Trainers in Agricultural Education. Published by The Interstate, Danville, Ill. 35 pp. Price not indicated.

* * *

The process by which a resource-using industry locates a major plant is examined in a case study published by the University of Alabama Press for the Inter-University Case Program. The report, *From Forest to Front Page,* deals with the establishment of the $60,000,000 newsprint manufacturing plant of the Bowaters Southern Paper Corporation at Calhoun, Tenn. The study was financed from a grant from Resources for the Future, Inc., to the Inter-University Case Program for studies of administrative aspects of natural resource problems. The report was written by Roscoe C. Martin, head of the Department of Political Science at Syracuse University.

The study covers a ten-year period leading up to the Calhoun plant's opening in 1954. Part I describes selection of the plant site and the Bowaters company's relations with federal agencies in the obtaining of a Certificate of Necessity. Part II covers subsequent negotiations with regional, state, and local government. Both parts of the report deal extensively with underlying problems of resource policy.

Copies of the 72-page, illustrated, report are available from bookstores or the University of Alabama Press, University, Alabama, at $1.25 each, with discount for bulk orders.

* * *

The Subcommittees on Hydrology and Sedimentation, Inter-Agency Committee on Water Resources, have sponsored the preparation of an *Annotated Bibliography on Hydrology 1951-54 & Sedimentation 1950-54 (United States and Canada),* Joint Hyrology-Sedimentation Bulletin No. 7, December 1955.

This bibliography, compiled and edited for these Subcommittees by the American Geophysical Union, National Academy of Sciences, covers all known literature concerning hydrology and sedimentation published in the United States and Canada during the specified periods. It was prepared primarily as a reference work for use by Federal Agencies having membership on the Inter-Agency Committee on Water Resources. A copy of the limited edition is being distributed to individuals and institutions having official connection with the federal argencies in the fields of hydrology and sedimentation.

Copies are being made available to the general public through the Superintendent of Documents, Washington 25, D.C., at a charge of $1.25 per copy.

* * *

Tale of an Alaska Whale by A. W. Blackerby and Linn A. Forrest (Binfords and Mort, Publishers, Portland, Ore. 30 pp. $1. 1955) is an engaging presentation by text and drawing of an ancient Indian legend—the origin of the killer whale or black fish. It is the story of how a young Indian brave, banished from his tribe because of the jealousy of his less athletic fellows, carved the killer whale from Alaska Cedar and reaped vengence upon his enemies, after two unsuccessful attempts to create the whale first from Alder wood, which was too heavy, and then from Red Cedar, which was too light. A delightful little book for youngsters. Well related in authentic fashion as told to the authors by the Indians and engagingly illustrated. Illustrator Forrest is an architect who was for a number of years engaged in a C.C.C. project of the Forest Service in restoring some of the famous totem poles and community houses of the Indians of the Alaska Panhandle. Author Blakerby is a forester who worked in Alaska from 1939 to 1955.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*
Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

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Society Affairs

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1956-1957

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The President's Column

DEWITT NELSON

Now is the time for foresters throughout the country to plan to attend the 1956 meeting of the Society in Memphis from October 14 through October 17, 1956. I know of no greater opportunity offered foresters for inspiration, exchange of knowledge, and the pleasure of good fellowship. There is no substitute for the immeasurable benefits that accrue from attendance at an annual meeting.

To underscore this I have invited two foresters, widely separated in age, in interest, and in location to be my guests in this column. This month I am proud to present Mr. Philip T. Coolidge, consulting forester from Bangor, Maine. Phil is one of the grand old timers of the Society.

"Forestry is booming. Fifty years ago there was the real beginning, with reservation of public lands for national forests and with establishment of good systems for protection against fire. Progress in methods followed steadily, but now since World War II we have the real initiation of the intensive and technical methods the old timers dreamed about.

"The spear point of our achievements and of what we can hope to do is the Society of American Foresters. All its activities make it an operating university of forestry. We have learned long since as foresters that knowledge and technical skill are the essentials for up-to-date accomplishment, and our background needs to be at least continental. A forester's perspective for his best work needs a glimpse of the principal forest regions, and acquaintance on the ground with his fellow foresters working in them. The West Coast, the South, and the Northeastern United States and Canada are all related in problems and interests.

"I became a member of the Society in 1910. I have lost track of the number of Society meetings I have attended, but I have not forgotten some that I wish I had not missed. Meetings in more recent years have given first opportunity to meet men of whom I have long heard. We sit together to discuss seriously or humorously our various experiences, and it is refreshing indeed to be together in a group, each member of which knows the pleasure, and the pleasure of the hardships, of roughing it in the woods.

"I wish that I could experience our activities for another fifty years, but you can be sure that I shall keep in close touch with men and forestry progress all over the country as long and actively as I can. We get out of any institution what we put into it, but the old timers need to know the younger men as much as we hope the younger men feel that they can gain by knowing us. The more of the younger men at our Society meetings the better.

"Forestry and our Society are continuing activities, nationwide, and that is why we hope for the biggest turnout possible at all our meetings. This year comes Memphis, the center of a great region and group with which I have yet but little acquaintance. We shall hope for all hands there.

"We keep the woods in mind, and to close with a hint of humor, I am thinking of the lumber camps, one third of the crew coming and one third going. But let us have the Memphis meeting all thirds there.

"See you in Memphis."

/s/ PHILIP T. COOLIDGE

Biographical Sketch, Philip T. Coolidge

Philip T. Coolidge graduated from Harvard, A.B., 1905, and from Yale School of Forestry, M.F., 1906.

From 1906-1909, with the U. S. Forest Service in Wyoming, Arizona and Colorado.

1909-1912, professor, Colorado School of Forestry at Colorado Springs, Colorado.

1912-1913, director, New York State Ranger School.

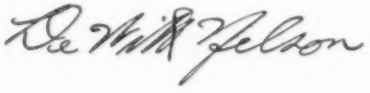
1914, national forest acquisition work in Maine and Pennsylvania.

1915-1916, assistant state forester of New Jersey.

Since 1916, consulting forester at Bangor, Maine, working generally in the northeastern United States and Canada, including work as land bank appraiser (farm mortgages) from 1927-1947.

Member of the Society of American Foresters since 1910.

Also member of the Canadian Institute of Forestry. He has authored a number of articles for the JOURNAL OF FORESTRY.



Coming Events

Northeastern Forest Tree Improvement Conference

A two-day summer meeting of the Fourth Northeastern Forest Tree Improvement Conference will be held at Johnsonburg, Pa., on August 7 and 8. Meetings will be held in the field and will center around discussions of the application of genetic concepts and methods to timber management.

Ernst J. Schreiner, c/o Morris Arboretum, Philadelphia 18, Pa., is executive secretary of the conference.

Upper-Mississippi Valley Section

The Upper-Mississippi Valley Section, S.A.F., will hold its summer meeting August 17-18 at Bottineau, North Dakota.

Allegheny Section Meeting

The Allegheny Section of the S.A.F. will hold its meeting in Ocean City, Md., September 6-7, 1956.

Wisconsin-Michigan Section

The Wisconsin-Michigan Section will meet September 14-15 at Shawano, Wisc. The program will include a tour of the Menominee Indian Reservation to observe forest management problems on lands that will soon be turned over to the Indians. Wisconsin Attorney General Vernon Thomson, chairman of the Menominee Study Committee, will discuss the state's viewpoint of problems involved in the future of these lands which contain one-tenth of the state's saw timber.

New York Section

The summer meeting of the New York Section will be held September 13 and 14 at Whitney Park, Sabbatis, N. Y.

Canadian Forestry Association

The Canadian Forestry Association will hold a National Forestry Conference in Winnipeg, Ontario, Canada, September 17-19, 1956.

Society of American Foresters Annual Meeting

Annual meeting of the Society of American Foresters will be held in Memphis, Tenn. at the Peabody Hotel, October 14-17, 1956.

SCHOOL BOX SCORE 1956 MEMBERSHIP

School	Student applications received: July 1956	Total 1955	Total 1956
Alabama Polytechnic Institute	0	18	6
University of California	0	17	34
Colorado A & M College	2	9	22
Duke University	0	3	4
University of Florida	1	17	4
University of Georgia	12	28	15
University of Idaho	2	4	18
Iowa State College	2	22	13
Louisiana Polytechnic Institute	0	13	12
Louisiana State University	0	43	12
University of Maine	0	12	11
University of Massachusetts	1	11	13
Michigan State University	0	14	26
University of Michigan	0	21	18
University of Minnesota	0	19	25
University of Missouri	0	26	1
Montana State University	0	25	17
State University of New York	2	23	37
North Carolina State College	0	22	3
Oregon State College	3	38	29
Pennsylvania State University	3	32	19
Purdue University	0	24	16
Utah State Agricultural College	0	12	7
University of Washington	0	28	13
West Virginia University	2	26	3
Yale University	0	16	12
Totals	30	523	390

SECTION BOX SCORE 1956 MEMBERSHIP

Section	Applications received[1]: July 1956	Total 1955	Total 1956
Allegheny	7	63	37
Appalachian	2	38	21
Central Rocky Mountain	3	12	24
Central States	0	44	19
Columbia River	6	100	54
Gulf States	6	107	43
Inland Empire	2	10	25
Intermountain	0	18	14
Kentucky-Tennessee	1	9	7
New England	3	50	50
New York	3	33	40
Northern California	0	33	43
Northern Rocky Mountain	0	44	24
Ozark	4	47	12
Puget Sound	2	65	33
Southeastern	18	85	49
Southern California	0	3	1
Southwestern	0	12	0
Upper-Mississippi Valley	4	51	45
Washington	0	2	1
Wisconsin-Michigan	3	40	64
Totals	64	866	606

[1]Students, Junior, Affiliate, Associate (Initial) grades only.

Schedule of Events for S. A. F. Annual Meeting

"Forestry Faces Forward" is the theme of the fifty-sixth annual meeting of the Society of American Foresters to be held in Memphis, Tennessee, October 14-17. Headquarters will be the Peabody Hotel.

President DeWitt Nelson, who will open the first general session on Monday morning, October 15, has announced that all foresters and friends of forestry everywhere are welcome to attend.

Meetings of the Society's eleven subject Divisions will be held on Tuesday and Wednesday, October 16 and 17. Foresters with specialized interests will have opportunities to attend technical sessions on forest management, public relations, forestry education, forest economics and policy, forest recreation, watershed management, and wildlife management.

The Society's annual dinner will be served Wednesday evening, October 17. There will be presentations of the Gifford Pinchot Medal, the Sir William Schlich Memorial Medal, and two new awards for achievement in biological research leading to the advancement of forestry.

Post-meeting field trips to acquaint visitors from other regions with forestry progress in the South are being arranged for Thursday and Friday, October 18 and 19. Special events have been planned for the ladies.

Russell Stadelman, general chairman for the meeting, suggests that members plan to arrive in Memphis on Sunday, October 14, or not later than Monday morning. George Romeiser, chairman of the committee on arrangements, is making plans for a total attendance of 1,200 Society members and guests. The program, whose committee chairman is P. A. Briegleb of New Orleans, promises to be one of the most interesting in the Society's history.

Information about hotels and room reservations, together with other details about the meeting will be published in the next issue of the JOURNAL OF FORESTRY and in subsequent issues.

Schedule of Events

Sunday, October 14

S.A.F. Council Meeting: morning and afternoon
Editorial Board, JOURNAL OF FORESTRY: evening
Association of Consulting Foresters: evening
S.A.F. Council and Section officers: evening

Monday, October 15

General session: morning
Society Affairs session: afternoon
Division of Private Forestry: evening
Division of Range Management: evening
Division of Education: evening
Division of Forest Recreation: evening

Tuesday, October 16

Division of Silviculture: morning and afternoon
Division of Economics and Policy: afternoon
Division of Forest Products: afternoon
Ladies forestry forum: morning
Division of Watershed Management: morning
Social evening

Wednesday, October 17

Division of Forest Management: morning and afternoon
Division of Public Relations: morning
Division of Wildlife Management: afternoon
Recepton and social hour: evening
Annual dinner

Washington Section Elects New Officers

At an election held by mail ballot on May 24, the following officers have been elected for the Washington (D. C.) Section for one-year terms:

Chairman, Albert W. Sump.
Vice Chairman, Gordon R. Heath.
Secretary, Glenn A. Thompson.

All are in the U. S. Forest Service, Washington, D. C.

D. J. Weddell (1903-1956)

Donald J. Weddell, 53, dean of the School of Forestry, University of Georgia, died suddenly in an Athens, Ga. hospital of a heart condition on May 31.

Born September 25, 1903 in Sault Ste. Marie, Mich., he attended Michigan State College, receiving the B.S.F. degree in 1928 and the M.S. (forestry) degree in 1932.

Following graduation he went with the Florida Forest Service for two years. In 1934 he was appointed to the forestry faculty at Alabama Polytechnic Institute and was assigned to teaching and research.

For a brief period in 1939 he was acting director of the Division of Forestry in the Georgia Department of Natural Resources. In September of that year he was appointed dean of the University of Georgia School of Forestdy.

Mr. Weddell was a member of Xi Sigma Pi and was active in the Association of Southern Agricultural Workers' Forestry Section. A member of the Society of American Foresters since 1931, he was chairman of the Southeastern Section in 1939, secretary of the Division of Education in 1949, and served on the Committee on Civil Service from 1948 through 1953.

He was the author of a number of papers and bulletins on forestry subjects.

Bernard A. Chandler (1884-1956)

Bernard Albert Chandler, 71, of Westmoreland Heights, Md., died on May 28, 1956. He was born December 20, 1884 at New Gloucester, Maine, received his Bachelor of Science degree from the University of Maine and his master's in forestry from Yale University. He first entered forestry work with the Vermont Forestry Department in 1911 following graduation from Yale. Several years prior to his death he had retired from the position of senior valuation engineer in the Bureau of Internal Revenue.

In addition to his varied professional career in the Northeast, Mr. Chandler was the author of numerous articles and bulletins on forestry and on the accounting and business aspects of forestry. He first became a member of the Society of American Foresters in 1914 and was an active member throughout his life, serving as Society treasurer in 1928, Council member in 1929, and chairman of the Washington Section in 1924.

Donald W. Winters (1906-1956)

Donald W. Winters, 49, of Murphysboro, Illinois, died April 18 after a long illness.

Born December 6, 1906 in Houston, Texas, he attended the University of Michigan receiving his B.S.F. degree in 1929. He served on the forestry staff of the Long-Bell Lumber Company at Longview, Washington, spent a year with the Brazilian Forest Service, and filled various assignments with the U. S. Forest Service in its North-Central Region. During World War II he was sent to Colombia and Mexico in search of sources of quinine for the armed forces. In 1946 he left the Forest Service to enter private industry in southern Illinois.

He was active in the Central States Section of the Society of American Foresters and the Illinois Association of Technical Foresters.

Kenneth A. Reid (1895-1956)

Kenneth A. Reid, 61, of Connellsville, Pa., died of a heart ailment May 21.

Born in Connellsville April 14, 1895, Mr. Reid was educated at Yale University, receiving the Ph.B. degree in 1917.

During World War I he was a lieutenant in the Army Air Service. Subsequently, he was director of the Pennsylvania Board of Fish Commissioners (1932-1938), and executive secretary of the Izaak Walton League and editor of *Outdoor America* (1938-1949). In the latter year he was appointed superintendent of natural resources for Whitney Industries, Inc., of Sabbotis, N. Y. which position he held until his retirement because of poor health two years ago.

He was an Associate member of the Society of American Foresters.

Opportunities in Foreign Forestry Employment

Since the beginning of American technical assistance to the so-called underdeveloped countries, the Society of American Foresters has occasionally been requested to suggest candidates for forestry assignments abroad. Although the number of U. S. foresters so engaged has never been large—perhaps not more than forty at any one time—it has often been difficult to find suitable candidates for such positions.

Both as a service to members of the Society and as a means of cooperating more effectively with agencies seeking the Society's help, it has been decided to set up and maintain a list of foresters interested in foreign assignments. In order that this roster may fully serve the purpose, it must be limited to foresters who are willing to pull up stakes for one or two years and who, together with their families, are prepared to live and work under foreign conditions.

A high degree of physical fitness is a prerequisite and there are specified age limits for some positions. Generally, a person beyond his early 60's is considered too old for such work. Exceptions are made chiefly in the case of outstanding specialists whose reputations may outweigh the possible handicap of age.

As the underdeveloped countries generally expect to receive "expert" assistance, there is little demand for recent forestry graduates. Hence, for the present at least, foresters having less than ten years' professional experience will not be placed on the list.

The variety of assistance that may be requested is so wide than too much space would be required to describe it. There may be somewhat greater needs for specialists, such as in reforestation or forestation, forest surveys, logging and sawmilling, etc., but there are also requests for foresters as general advisers. There are opportunities in both forest management and forest utilization, and also in the fields of forestry education and extension. Persons considering whether to have their names placed on the list will of course wish to know something about conditions of employment in the principal agencies engaged in foreign aid.

I. C. A.

The normal length of initial assignment with the International Cooperation Administration, a U. S. Government agency, is two years with the possibility of extension.

The base salary is similar to that for comparable work in the U. S. Government, with the addition in some countries of an overseas hardship allowance (or post differential) amounting to as much as 25 percent of the base salary in the least desirable posts. Both the base salary and post differential are subject to federal income tax. A technician and his family are usually housed in government-owned or rented quarters, or, if not available, he is given a quarters allowance. Also, for some countries there is an additional cost-of-living allowance which is intended to compensate for basic living expenses at the post, exclusive of quarters, in excess of the cost of living in Washington, D. C.

Transportation of the technician's family and household goods to and from the assigned post are at government expense. There are provisions for medical care, insurance, leave, etc.

F. A. O.

The Food and Agriculture Organization of the United Nations is an international organization and draws upon many of its member nations for forestry technicians to staff E.T.A.P. (Expanded Technical Assistance Program). Like I.C.A., it extends technical assistance to the underdeveloped countries and offers opportunities for employment covering the entire field of forestry. F.A.O.'s forestry program is considerably larger than I.C.A.'s, measured by number of foresters employed, but fewer U. S. foresters are employed by F.A.O. than I.C.A., for the reason that F.A.O. recruits foresters of many nationalities.

The usual initial appointment with F.A.O. is for one year, with the possibility of extension. The net base salary is similar to that indicated above. Technicians appointed for one year or more are deemed to be on "full-term" status. Full-term technicians receive a "project service allowance" computed to cover cost of suitable lodging, and also an allowance for each dependent equivalent to U. S. $200 per annum.

Transportation of dependents of full-term technicians and of household goods is paid by F.A.O. to the duty station and return. There are provisions for life and travel insurance, reimbursement for medical care, leave, etc.

Organized Missions

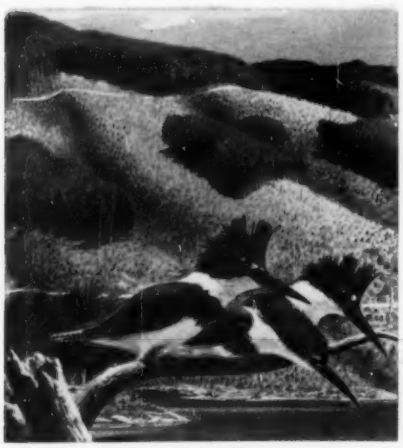
Foresters employed by either I.C.A. or F.A.O. on technical assistance assignments are attached to organized missions that are composed of administrative officers and technicians in various fields, the whole group under a mission chief and operating as a team. Technicians act in an advisory capacity and generally are assigned to work

MAKING WOOD SERVE AMERICA BETTER THROUGH GOOD FOREST MANAGEMENT

DR. CARL ALWIN SCHENCK (1868-1955) at dedication of Schenck Unit of the Weyerhaeuser Millicoma Tree Farm in 1951, honoring his many contributions to American forestry. Founder of Biltmore Forest School in 1898, the nation's first such school, he wrote many of its textbooks and trained nearly 400 men who did much to advance practical forestry in the United States.

a prophecy come true...forests for the future by tree farming

Graphic example of a prophecy come true... forest resources being perpetuated in the Douglas fir region. Seed trees have been left to reforest nearby harvested areas.



When Dr. Carl Schenck, forester and teacher, first came to this country in 1895, little was being done to properly manage the nation's industrial forests. However, based on his knowledge of successful European forest management programs, he flatly predicted that owners of American timberlands also would perpetuate their forest resources as the demand for wood grew. Dramatic evidence that this prophecy has come true is the development of modern forestry and tree farming. Dedication in 1941 of the Weyerhaeuser Clemons Tree Farm marked the beginning of the tree farm program. Since that time, the movement has grown on a national scale to a total of 8,076 tree farms, consisting of about 39 million acres.

A tree farm is a privately owned area of forestland dedicated to growing timber as a perpetual crop. Each tree farmer agrees to protect his trees from fire, insects and disease, carry out a clean, systematic log harvest and provide for natural or artificial reforestation of cutover land.

All Weyerhaeuser Timber Company forestlands are certified tree farms, managed by trained foresters as permanent wood-producing lands. *For free literature about tree farming, write us at Box A, Tacoma, Washington.*

Weyerhaeuser Timber Company

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4-SQUARE

closely with a national of the cooperating country who has training in the given technical field and who is referred to as a counterpart.

Occasional requests for foresters for overseas assignment are also received from other international organizations, private foundations, industry, etc. Conditions of employment vary too widely to permit detailed information.

Technical Assistance Roster

The list, to be maintained in the Society's Washington office, is a purely voluntary means of cooperating with agencies engaged in foreign work requiring the services of foresters and seeking the Society's help in locating suitable candidates.

If you are interested in having your name placed on this list, please write to *Technical Assistance Roster*, in care of the Society, and include with your letter the information customarily needed by a recruiting agency as a preliminary basis for judging a person's qualifications for a particular position. Provide enough information on your personal history, professional training, special interests, etc., to permit some degree of classification according to field of specialization and other principal factors, affecting an individual's suitability for a given position.

Please do not write to the Society requesting information about the kinds of openings available in specific countries. The Society does not have such information.

V. L. HARPER, *Chairman*
Committee on International Relations

Membership Advancements

Confusion exists in the minds of some members regarding advancement in membership grades. Any qualified member may make *application* for advancement. It is not necessary that he be nominated or that the Section initiate his application.

Requirements for advancement are outlined in detail in the Society's Constitution and Bylaws. For the information of all members these requirements are briefly outlined below.

Student Member to Junior Member. Student Members are eligible for advancement to the Junior grade, immediately upon graduation. In applying for Student Membership they, in effect, apply for advancement to the Junior grade as soon as they meet the requirements. Inasmuch as Student Members are automatically advanced, when qualified, application need not be made for advancement.

Affiliate Member (Class A) to Junior Member. The Class A Affiliate Member is one who graduated in forestry from a nonaccredited school. The only additional requirement for advancement to the Junior Member grade is two years of qualifying experience since his election to the Affiliate grade. (Note that this is since election to the Affiliate grade, not two years since graduation.) In other words, a Class A Affiliate Member who graduated in forestry from a nonaccredited school and became a member in 1954 might well qualify now for advancement to the grade of Junior Member if he meets the requirement of "qualifying experience." "Qualifying experience" means employment in forestry work which may be broadly interpreted to include forest management and the growing of forest crops, protection, research, survey, wildland work such as range,

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E. F. McCarthy (1885-1956)

Edward F. McCarthy, 71, of Chittenango, N. Y., died May 21. He had served on the faculty of the State University of New York College of Forestry at Syracuse for 29 years.

Born in McLean, N. Y., January 4, 1885, he was graduated from the State Normal School at Cortland in 1905. Following a period of school teaching and work in the lumber woods, he entered the University of Michigan, receiving the B.S. degree in 1911, and also completed the work for the M.S.F. degree during that year.

In the fall of 1911 he joined the faculty of the New York State College of Forestry at Syracuse, and in 1914 was transferred as full professor and acting director of the State Ranger School at Wanakena.

Subsequently, McCarthy entered the U. S. Forest Service. After a brief assignment to national forest administration, he was transferred to research work, and eventually became director, first of the Appalachian (now the Southeastern) Forest Experiment Station, and later of the Central States Station.

In 1931 he returned to the College of Forestry at Syracuse as chairman of the Department of Silviculture, which position he held 17 years until his retirement in 1948.

He was the author of numerous papers and other publications on forestry subjects. He was a member of the Society of American Foresters for forty years. During 1925-1926 he was chairman of the Appalachian Section; chairman of the Central States Section in 1930; and chairman of the New York Section during 1946-1947.

wildlife, and recreation, erosion control work definitely tied into forest or wildland management, and utilization if it has a definite relationship to growing forest crops.

The *Class B Affiliate Member* is one who entered the Society on the basis of experience alone or experience plus some professional forestry education. Two additional years of qualifying experience in forestry since his election to Affiliate Membership is required, but, more specifically, evidence that the candidate has the equivalent of the education of a forestry school graduate. In other words the applicant's qualifying experience must show that, during his total experience, he has gained the knowledge of all the basic courses which must be included as a minimum in an approved curriculum in an accredited forestry school.

The *Class C Affiliate Member* is one who graduated from an accredited forestry school and majored in wood technology, wildlife management, or range management where these curricula did not include all the five professional forestry courses. The only additional requirement for the advancement to Junior Member is two years qualifying experience since being elected to the Affiliate grade.

Regular advancement from Junior Member to Member. The applicant for regular advancement must meet three basic requirements: (1) at least three years of qualifying experience after first becoming eligible for election to the Junior grade, (2) actively engaged in forestry work, (3) demonstrated competence as a professional forester. Please note that the date of his election to Society membership is immaterial. Normally, an applicant for regular advancement to the grade of Member will qualify three years after graduating from an accredited school of forestry. He must, of course, meet the two other requirements.

All the above applications for advancement must be supported by statements of endorsement from three voting members and show Section endorsement.

Members, qualified for advancement, are urged to apply now. Application forms can be obtained from your Section officers or the Society's office, 425 Mills Building, Washington 6, D. C.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of May are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of August 1, 1956. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section
Student Grade

PENNSYLVANIA STATE UNIVERSITY
Ache, R. K. Rygwalski, E. D.
Davidson, K. A.

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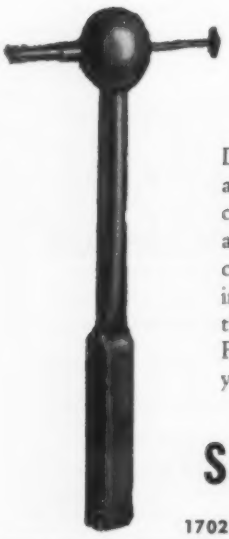

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WEST VIRGINIA UNIVERSITY

Kaunike, R. L. Paxton, J. S.

Junior Grade

Frank, O. L., Forester, Pa. Dept. of Forests & Waters, Clearfield, Pa.; Pa. State, B.S.F., 1949.

Schmidt, R. L., Asst. Dist. Forester, Pa. Dept. of Forests & Waters, Huntingdon, Pa.; Pa. State, B.S.F., 1943.

Appalachian Section

Junior Grade

Williams, J. F., Consulting Forester, Windsor, N. C.; Duke, M.F., 1947.

Affiliate Grade

Jones, A. F., Field Agent, Canal Wood Corp., Abbeville, S. C.; Stephen F. Austin State College, B.S., (Forestry), 1949.

Central Rocky Mountain Section

Student Grade

LaMay, T. W. Roberts, T. D.

Affiliate Grade

Jacobson, L. H., Asst. State Forester, S. Dak. Dept. of Game, Fish & Parks, Rapid City, S. Dak.; Mich. College of Mining & Tech. B.S., (Forestry), 1950.

Columbia River Section

Student Grade

OREGON STATE COLLEGE

Bell, T. E. Overbay, J. C.
Mulkey, L. V.

Junior Grade

Bonney, M. C., Resident Forester, The Long-Bell Lbr. Co., Longview, Wash.; Oregon State, B.S.F., 1929. Reinstatement.

Burgess, D. G., Forester, Bureau of Land Mgmt., Roseburg, Ore.; Univ. of Wash., B.S.F., 1951.

Van Vliet, A. C., Instructor, Oregon State College, Corvallis, Ore.; Oregon State, B.S.F., 1953.

Member Grade

Jackson, J. M., Forester, U. S. Indian Service, Klamath Agency, Ore. (Junior, 1947).

Kjosness, J. O., Timber Buyer, Umpaqua Plywood Corp., Myrtle Creek, Ore. (Junior, 42R55).

Larson, R. L., Cruiser, C.D. Johnson Sub. of Ga. Pacific, Toledo, Ore. (Junior, 1949).

Stevenin, H. L., Forester, Bureau of Land Mgmt., Salem, Ore.; U. of Mo., B.S.F., 1951 (Junior, 1951).

Wilkinson, R. D., Logging Eng., Bert W. Udell, Lebanon, Ore. (Junior, 1949).

Affiliate Grade

Mosar, R. M., Forester, Crown Zellerbach Corp., Seaside, Ore.; Ore. State, B.S., (Fish & Game Mgmt.), 1948.

Gulf States Section

Junior Grade

Branton, R. T., Asst. Forester, H.L. Bango, Shreveport, La.; L.P.I., B.S.F., 1950.

Logan, D. L., Forest Tech., International Paper Co., Springhill, La.; L.P.I., B.S.F., 1948.

Rowland, L. A., Director, Miss. Forestry Comm., Jackson, Miss.; La. State, B.S.F., 1947. Reinstatement.

Wampler, A. E., Field Asst., International Paper Co., Colfax, La.; La. State, B.S.F., 1952.

Williams, J. A., Forester, U.S.F.S., New Orleans, La.; Pa. State, B.S.F., 1955.

Affiliate Grade

Curlin, J. W., Asst. Regional Forester, Kirby Lbr. Corp., Cleveland, Texas; Ark. A & M, B.S., (Forestry), 1954.

Jeffrey, B. G., Dist. Forester, Kirby Lbr. Corp., Cleveland, Texas; Ark. A & M, B.S., (Forestry), 1955.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO

Krueger, K. W. Whittig, J. F.

Intermountain Section

Member Grade

Marston, R. B., Forester, U.S.F.S., Farmington, Utah. (Junior, 1949).

Kentucky-Tennessee Section

Junior Grade

Churchwell, N. R., Asst. Dist. Forester, Tenn. Div. of Forestry, Lexington, Tenn.; Univ. of Ga., B.S.F., 1954.

New England Section

Student Grade

UNIVERSITY OF MASSACHUSETTS

Buker, F. M.

Member Grade

Dwyer, W. W., Consulting Forester, Hopkinton, N. H. (Junior, 1949).

Maines, J. T., Asst. Mgr., Great Northern Paper Co., Bangor, Me. U. of Me., B.S.F., 1940. Reinstatement.

Affiliate Grade

Gifford, P. E., Supt., Clinton State Forest Nursery, Clinton, Mass.

Ricard, J. Q., Dist. Fire Chief. State of N. H., Canaan, N. H.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK

English, J. E. Fromm, R. W.

Affiliate Grade

Sievers, F. U., Area Leader, U.S.F.S., Albany, N. Y.

Ozark Section

Junior Grade

Hoover, C. C., Sales Mgr., Forest Products, Inc., Casseville, Mo.; Iowa State, B.S.F., 1942.

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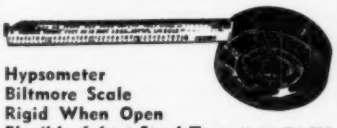

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Kelly, F. M., Forest Tech., International Paper Co., Rison, Ark.; L.P.I., B.S.F., 1951.

Member Grade

Bammert, R. F., Tree Surgeon, Bruns Shade Tree Service, St. Louis, Mo.; Univ. of Mo., B.S.F., 1951. (Junior, 1952).

Bruns, R. R., Owner, Bruns Shade Tree Service, Overland, Mo.; Univ. of Mo., B.S.F., 1951. (Junior, 51R55).

Edscorn, K. C., Supv. of Treatment, Mo. Pacific Railroad Co., Kansas City, Mo.; Univ. of Mo., B.S.F., 1950. (Junior, 1951).

Kernik, J. L., Forester, U.S.F.S., Huston, Mo. (Junior, 1947).

Moran, H. B., Farm Forester, Mo. Cons. Comm., Steelville, Mo.; Univ. of Mo., B.S.F., 1950. (Junior, 51R55).

Mugford, D. G., Asst. Forester, Mo. Cons. Comm., Licking, Mo.; Mich. State, B.S.F., 1949. (Junior, 1953).

Raisch, R. D., Dist. Forester, Mo. Cons. Comm., Piedmont, Mo.; Univ. of Mo., B.S.F., 1950. (Junior, 1952).

Robine, C. L., Farm Forester, Mo. Cons. Comm., Monett, Mo.; Univ. of Mo., B.S.F., 1951. (Junior, 1953).

Wood, E. B., Mgr., Cloud Oak Flooring Co., West Plains, Mo.; Univ. of Mo., B.S.F., 1950. (Junior, 1951).

Affiliate Grade

Couch, G. A., Dist. Forester, Dierks Forests, Inc., Hollis, Ark.; Okla. A & M, B.S., (Forestry), 1952.

Associate Grade

Drey, L. A., Owner, Pioneer Forest, St. Louis, Mo.

Puget Sound Section

Junior Grade

Kissinger, N. A., Forester, U.S.F.S., Okanogan, Wash.; Colo. A & M, B.S.F, 1950.

Affiliate Grade

Warner, E. V., Dist. Forest Warden, State of Wash., Ellensburg, Wash.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA
Moody, C. W.

UNIVERSITY OF GEORGIA

Beall, G. S. — Lightsey, A. L.
Beason, R. J. — Morris, F. J.
Butts, P. M. — Swindel, B. F.
Crane, W. B. — Terry, R. J.
Eidson, D. S. — Vickers. B. E.
Jordan, J. R. — Whitfield, A. P.

Junior Grade

Cooper, N. O., Working Circle Forester, St. Regis Paper Co., Cantonment, Fla.; L.P.I., B.S.F., 1951.

Exley, G. C. Asst. Logging Supt., Ga. Pacific Plywood Co., Savannah, Ga.; Univ. of Ga., B.S.F., 1949.

Foreman, E. E., Asst. Forester, Union Bag & Paper Corp., Savannah, Ga.; Duke, M.F., 1956.

Maves, H. A., Dist. Forester, Interstate Land & Imp. Co., Forsyth, Ga.; Purdue, B.S.F., 1952.

Affiliate Grade

Beaumont, C. E., Consultant Forester, Hapeville, Ga.; Yale, Ph.B., 1909.

Upper-Mississippi Valley Section

IOWA STATE COLLEGE

Edgren, J. W. — Medin, D. E.

Affiliate Grade

Clegg, A. G., Lumber Grader, Woodruff Lbr. Co., Duluth, Minn.; Mich. College of Mining & Tech., B.S., (Forest Production), 1953.

Franz, M. H., Asst. Forester, Minn. & Ont. Paper Co., Big Falls, Minn.; Mich. College of Mining & Tech., B.S., (Forestry), 1952.

Wisconsin-Michigan Section

Junior Grade

Elliott, K. M., Forester, U.S.F.S., Three Lakes, Wis. (Affiliate, 1953).

Irwin, A., Plant Mgr., General Box Co., Detroit, Mich.; Yale, M.F., 1940.

Member Grade

Lashley, O. L., Forester, U.S.F.S., Baldwin, Mich.; Univ. of Mo., B.S.F., 1951. (Junior, 1951).

Affiliate Grade

Herridge, A. J., Dist. Forester, Dept. of Lands & Forests, Sault Ste Marie, Ont., Canada; Univ. of Toronto, B.S., (Forestry), 1949.

Matson, P. L., Sealer, Scott Paper Co., Garden City, Mich.; Mich. College of Mining & Tech., B.S., (Forestry), 1954.

Foreign

Junior Grade

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Forestry News

Forest Farmers Meet

The 15th Southern Forestry Conference, sponsored by the Forest Farmers Association, was held in Charleston, S. C. on April 19 and 20. Nearly 400 timber growers and processors, industrialists, state and federal forestry officials, educators, and forest fire technicians and research workers participated. Purpose of the 15th Conference was (1) to focus attention on the magnitude of the forest fire problem in the South and (2) to chart a course of selective action to meet this problem.

Speakers included national and regional forestry and industrial leaders, former Georgia Governor Talmadge, who was given the 1956 Forest Farmer Annual Award for oustanding contributions to forestry, and Swedish Ambassador Erik Boheman.

Forest Service to Try Cloud Seeding as Lightning Control Measure

Cloud seeding as a means of preventing or reducing the severity of lightning will be tried out in northern Arizona as part of a Forest Service sponsored program known as "Project Skyfire." This cooperative program is designed to learn more about the occurrence, behavior, and control of lightning caused fires.

Experiments will be carried out on the Coconino National Forest where lightning causes hundreds of fires annually. Lightning fires represent 65

FIRST OF A SERIES of three wildlife conservation postage stamps to be issued by the U. S. Post Office Department during 1956. Selected on the basis of being typically American and representing birds, mammals, and fish, the two remaining species of the series to be represented are pronghorn antelope and king salmon.

The commemorative stamps were designed by Bob Hines, artist of the Fish and Wildlife Service, which agency was given the responsibility for selecting the subjects.

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Minnesota

—Paul Bunyan land looks again to its tall timbers

In 1958 Minnesota celebrates its centennial. During this 100 years of development, generations of industrious people have built a new empire from the harvest of raw materials grown in soil and water.

The forest provided the backbone of this development,—building the home, factory, school and church. Wood was also exported to neighboring areas in exchange for cash or other goods to speed the taming of a wild country. When logging failed to clear the land fast enough, the early settler applied the torch, deeming the land of more value for agriculture.

By the turn of the century, the forest wealth that originally covered two-thirds of the state—and seemed inexhaustible to the pioneer forefathers, was a logged and burned remnant.

However, before that day came, a farsighted few had already begun the cry of "conservation" and with such great evidence of forest depletion as appeared in 1900-1910, others joined in to pass the first constructive conservation legislation.

This ended the pioneer exploitation era. Today about one-half of the original forest area is growing almost as much wood as is being cut. Forests once destroyed by fire are again covered with trees in various stages of growth.

Thus, in its second century, Minnesota turns conservation efforts to utilization. Large production of raw wood materials is expected to lure more industry and wood-using manufacture. Conservation will achieve its highest dollar-and-cents value.

But other benefits may outweigh the cash value of a board foot. Forest areas will be the home of wildlife; aid in the conservation of soil and water; and provide scenic beauties to be sold and used repeatedly for the recreational industry.

In every phase of good living, the forest has,—and continues to play—a vital part. Conservation of all natural resources is the responsibility and privilege of every American citizen.

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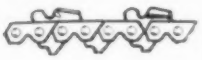

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percent of the forest fires in the Rocky Mountain states and 42 percent in the Pacific Coast states.

A specially built mobile radar unit will detect, track, and analyze lightning storms. It also will assist in comparing the results on seeded and unseeded cloud systems. This is the first use of radar in forest fire control. The unit is installed in a truck trailer adapted for this special purpose by the U. S. Weather Bureau.

Lightning storms and cloud systems in the project area will be observed from a network of fire lookout stations. Time lapse motion picture cameras on several towers will record the life cycle of lightning storms.

Actual cloud seeding will be on an exploratory basis only and will be limited to the occasions when isolated lightning storms develop that are suitable for this type of study. Silver iodide will be employed as the seeding agent either from a ground generator into ascending air currents or from an airplane. The silver iodide crystals emitted by specially designed generators act as nucleii for the formation of ice crystals in the clouds. This reaction under some conditions may affect the life history of the cloud which in turn could alter the lightning potential of the storm. It is hoped that such relationships can be turned to advantage to reduce the number of lightning fires.

Cooperating in the project are the President's Advisory Committee on Weather Control, the U. S. Weather Bureau, the National Park Service, and two private meteorological research organizations: the Munitalp Foundation, Inc. of New York City, and Meteorological Research, Inc. of Pasadena, California. The Intermountain and Rocky Mountain Forest and Range Experiment Stations and the Southwestern Region of the Forest Service are all participating in the research program.

Industrial & Private

Industries Groups Sponsor Career Festival

The Twin Cities forest products industries groups recently cooperated in sponsoring a "Careers Festival" for high school seniors and college students. Under the sponsorship of the Twin Cities Hoo-Hoo Club and leadership of E. R. Gillis, Weyerhaeuser Sales Co., St. Paul, a leaflet "The Tree of Promise," on career opportunities in the forest products industries was prepared for distribution to all interested students. It was estimated that between 20,000 and 30,000 students attended the "Careers Festival."

N. L. M. A. Scholarships in Products Research Awarded

Four outstanding forestry school students in Pennsylvania, Michigan, Iowa and North Carolina were awarded special scholarships this year by the National Lumber Manufacturers Association.

The winners, chosen from students nominated by 15 of the nation's leading forestry schools, are: Malcolm Hughes Stehman, Pennsylvania State University; Robert Allen Hann, University of Michigan; Dean Rodney Prestemon, Iowa State College; Anders Edward Lund, Jr., Duke University.

Each scholarship winner received cash awards of $500 and ten weeks' on-the-job training in wood products research, beginning June 25, at the Washington, D.C., laboratory of the

Timber Engineering Co., research affiliate of the National Lumber Manufacturers Association. Each winner also will be paid travel expenses to and from Washington, D.C.

The scholarship program is in its seventh year and is designed to encourage more students to seek employment in the private wood industries. Scholarship winners are chosen on the basis of their scholastic records, aptitudes, interests and extra-curricular activities.

West Virginia Pulp and Paper Builds New Nursery

West Virginia Pulp and Paper Company has announced that it is building a forest nursery in South Carolina capable of growing 20 million seedlings annually. The nursery will rank in size with the largest in the South and will enable the company to expand and improve its already extensive tree planting activity and make more seedlings available to small landowners.

The new installation will be erected on 50 acres of land located about 12 miles west of the Summerville, S. C., headquarters of the company's Southern Woodlands Division. Facilities will include a refrigeration room capable of holding one million seedlings at an even temperature of 35 degrees. Refrigeration will make it possible to extend planting three months beyond the normal season.

During the 1955-1956 planting season a record total of more than eight million seedlings were planted on company lands (750,000 acres, mostly in North and South Carolina), and it is anticipated that the company's requirements will more than double this number within the next several planting seasons, exclusive of free seedlings distributed to landowners.

A high proportion of the seedlings to be grown in the nursery will be slash and loblolly pine.

Education

Conference on Graduate Resource Training Held at Ann Arbor, Michigan

Sponsored by the Conservation Foundation, a Conference on Graduate Resource Training and Employment Needs was held at the University of Michigan on April 27 and 28, 1956. Aside from representatives of the Conservation Foundation, including its President, Fairfield Osborn, the Conference was attended by 26 men representing a variety of interests: 12 from educational institutions; 5 from State and Federal Governments; 3 from organizations particularly interested in conservation; and 6 from industry and finance.

After an opening session, the group was divided into five committees. Each was given the task of discussing a series of problems involved in resource-conservation training: placement problems; meeting the requirements of business, industry, and government; administrative problems within graduate departments of educational institutions; and the special objectives of formal resource training. The discussions of these committees were very stimulating and productive. General agreement seemed to be reached on a number of points: first, in itself, conservation is not a profession. For work in any particular branch of conservation, a basic requirement is education in a recognized specialized field such as forestry or geology. Second, specialists who understand conservation are needed in many fields of activity. There is a limited demand for such men in business, industry, and education; the demand is growing in resource-development organizations and areas; and at present

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the demand of Government for such men exceeds the supply. Third, industry feels the need to provide special training in conservation to selected men; partly to broaden their perspective in the field of resource management, and partly to provide specialists who could work on such problems as area development. It was suggested that such advanced training might be accomplished through leaves of absence for graduate training, short courses, or workshops and seminars. Such programs of graduate training in resource conservation might be spearheaded by the Conservation Foundation, sponsored by industry, and conducted by colleges and universities.

New Extension Field Office Established in New York

Dr. Hardy L. Shirley, dean of the State University of New York College of Forestry in Syracuse, has announced that the College Board of Trustees approved the establishment of a full-time forestry extension field office in Saranac Lake, effective July 1.

Appointed in charge of all Adirondack operations will be Professor James E. Davis.

Professor Davis supervised the Adirondack-Catskill forest survey and forest resources studies in Clinton, Essex, Franklin and Lewis Counties, for which the College maintained a research office in Harrietstown from May, 1952, to May, 1955. Since that time, he has returned to the area at frequent intervals for extension work, keeping a part-time office with the Adirondack Park Association. Working with the Saranac Lake Chamber of Commerce officials, he was influential in establishing a new wood-using industry at Saranac Lake.

The field office, part of the College's Department of Forest Extension, will serve the northern New York area—including the counties of Clinton, Essex, Franklin, Hamilton, Herkimer, St. Lawrence, Warren, Fulton, Lewis and Saratoga. Professor Ralph G. Unger is chairman of the Department of Forest Extension at the College of Forestry.

The extension program, according to Dean Shirley, will emphasize public, non-farm private, and industrial forestry. The services provided will augment the work of the farm forestry extension program of the College of Agriculture and the forest management services of the State Conservation Department."

Professor Davis received both his Bachelor of Science and his Master of Forestry degrees at Cornell University.

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Iowa State Summer Camp in Oregon

The Iowa State College Forestry Department will hold its annual summer camp for undergraduates again this year on the Deschutes National Forest.

Camp will be set up on Jack Creek about 2.5 miles west of Camp Sherman, Ore., and about 40 miles west of Bend, Ore. Classwork began June 18 and will close August 18. An Alumni Day will be held July 15, to which all ISC forestry graduates are invited.

In charge of the camp this year will be Dr. James Yoho, assisted by Dr. A. L. McComb, George Thompson, and Leonard Kellogg of the Forestry Department staff. Approximately 50 students will attend, most of them having just completed their freshman year. They will study wood utilization, forest operations, mensuration and silviculture.

The Iowa State College camp moves periodically to new locations in commercial timber areas of the nation. It was held on Jack Creek last year, and in other recent years has been held in Wyoming and Wisconsin.

Xi Sigma Pi National Officers Announced

The School of Forestry at the University of Georgia will serve as national headquarters for Xi Sigma Pi, forestry honor fraternity, during the biennium 1956-1958.

This fraternity, with more than 4,000 members, has chapters at 19 of the major colleges and universities across the United States which offer degrees in forestry. The objectives of Xi Sigma Pi are to secure and maintain a high standard of scholarship in forestry education, to work for the upbuilding of the profession of forestry, and to promote fraternal relations among workers engaged in forestry activities.

National officers chosen for the coming biennium were: D. J. Weddell, forester; L. W. R. Jackson, associate forester; and J. R. Parker, secretary-fiscal agent. (The subsequent death of Dean Weddell is reported elsewhere in this issue.) Dr. Jackson is professor of silviculture, and Mr. Parker is professor of forest economics. They were selected for these offices by their fellow faculty members.

Midwest Forestry Club Association Meets

The third annual Conclave of the Midwest Forestry Club Association was

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held May 4-6, at Iowa State College and was attended by forty foresters from the University of Purdue, University of Minnesota, and Michigan State University. The University of Michigan sent word at the last moment that they could not attend.

Friday evening, May 4, was registration time and the time of meeting old and new friends. Saturday was highlighted by tours of the campus in the morning while the afternoon featured contests of bucking, chopping, log rolling, log throwing, match splitting, rail splitting, chain throwing, traversing, tobacco spitting, and a dendrology contest.

The foresters of Purdue showed they were still just as good as last year by earning a total of 41 points for their school team. For this they receive the brand new traveling trophy. Michigan State University placed second in the contests with 23 points. Iowa State was third with 21 and University of Minnesota earned five.

The evening speaker was Dr. Wayne Shoultes, of Iowa State College, who spoke on the use of carbon-14 in dating wood.

The University of Purdue will be host for the fourth annual Conclave to be the first weekend of May in 1957.

Public

H. G. Lyon To U. S. Department of Agriculture Post

Homer G. Lyon, Jr., reforestation director for the Oregon State Board of Forestry, has been appointed assistant to Assistant Secretary of Agriculture E. L. Peterson, the former director of agriculture for the state of Oregon.

Lyon will be assigned to duties associated with the various agencies of the Department of Agriculture coming under Mr. Peterson's jurisdiction. These include the U. S. Forest Service, Soil Conservation Service, Extension Service, Farm Cooperative Service, Agricultural Research Service and the agricultural conservation program.

Lyon, a graduate of the school of forestry at Oregon State College, was with the Civilian Conservation Corps in 1933 and the following year entered the employ of the Coos County Forest Protective association with headquarters at Coos Bay, Ore. In 1937 he was transferred to the Salem office of the state forestry department as reforestation director and took over the administration of the forest fee and yield tax law. He has an extensive record of military duty, with the Third Army in Europe, the Japanese occupational forces in World War II, and in the Korean conflict. Upon release from service the second time in 1952 he held the rank of lieutenant colonel in the Army 409th Engineer Special Brigade.

Promotion of Missouri Foresters Announced

William E. Towell, Missouri assistant state forester who has headed fire control work for the Missouri Conservation Commission since 1942, has been named assistant to the director of the Commission, I. T. Bode. Osal B. Capps, district forester in the Commission's Division of Forestry, succeeds Towell as fire control chief under the direction of State Forester George O. White.

Towell, who holds both bachelor's and master's degrees from the University of Michigan, joined the Conservation Commission in 1938 as district forester during the inital phases of the state's present forestry program. He subsequently served as a farm forester before heading up fire control work.

Capps is also a forestry graduate of the University of Michigan. He joined the Commission as assistant district forester in 1948 and was promoted to district forester the following year.

Both men served in the Pacific Theatre during World War II, Towell as a photographic interpretation officer in the Navy, Capps with the Army, in which service he holds a reserve Major's commission.

Utilization Specialist on I.C.A. Assignment

Waldo M. Sands, an industry specialist in wood products, formerly with the U. S. Corps of Engineers at St. Louis, has gone to Cambodia as a specialist in wood utilization under the International Cooperation Administration.

A graduate in 1924 of Michigan State College, Mr. Sands was for a number of years with the U. S. Forest Service, attached to the Lake States Forest Experiment Station and the Forest Products Laboratory.

B. T. Campbell Appointed Superintendent of National Park

Acting Secretary of the Interior Clarence A. Davis on May 10th announced that Bernard T. Campbell, chief park ranger at Everglades National Park, Florida, had been appoint-

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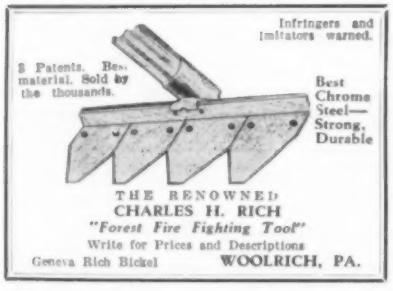

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ed superintendent of Petersburg National Military Park, Virginia.

Campbell is a graduate of the State University of New York College of Forestry. He has been chief park ranger at Everglades National Park since the summer of 1954 and has also served as chief park ranger for the Blue Ridge Parkway and as forester in the National Park Service's Region One Office in Richmond, Va. Prior to joining the National Park Service in 1938 he worked for five years as a forester with the U. S. Forest Service and the Resettlement Administration.

Campbell served in the Navy during World War II. He is a member of the S.A.F.

J. M. Mahoney Appointed National Monument Superintendent

John M. Mahoney, supervisory park ranger at Yosemite National Park, California, has been appointed superintendent of Muir Woods National Monument, California.

Mr. Mahoney joined the National Park Service in 1939 as a blister rust control foreman in Yosemite, and, except for Army duty during World War II, has been stationed there ever since. He is a native of Berkeley, California, has a B.S. degree in forestry from the University of California, and is a member of the Society of American Foresters.

Lee Muck Retires

Lee Muck, staff assistant to the Department of the Interior Assistant Secretary for Public Land Management, retired at the end of 1955 with more than 40 years of federal service.

Mr. Muck first entered federal service in 1913 as a forester on the Klamath Indian Reservation in Oregon after graduating in forestry from the University of Michigan. Successive assignments in forestry operations took him to a number of areas administered by the Bureau of Indian Affairs and he was for a period district forester for the northwestern states in which position he supervised forest protection and timber sales on Indian lands.

He had charge of the first comprehensive, nationwide study of grazing resources on Indian lands when the administration of those lands was transferred to the Forestry Branch of the Indian Bureau in 1930. During the existence of the Civilian Conservation Corps he was responsible for supervision of its activities on Indian lands in the Northwest.. In 1937 he was made director of forestry for the Bureau of Indian Affairs with headquarters in Washington, D. C. Four years later he became director of the newly established Division of Land Utilization in the department. Subsequently he was appointed to the staff position which he held until retirement. The Secretary of the Interior lauded Mr. Muck's career of public service and his achievement in adapting the theory of forestry to the requirements of practical administration.

McLintock Heads Lake City Research Center

Director E. L. Demmon of the Southeastern Forest Experiment Station announced the assignment of Thomas L. McLintock to the Lake City (Florida) Research Center as center leader replacing Kenneth B. Pomeroy. McLintock took over his new duties in April. He has been center leader at the Penobscott Research Center of the Northeastern Forest Experiment Station for the last six years. On this assignment at Bangor, Maine he worked primarily on forest research in cooperation with the pulp and paper companies in that area.

McLintock graduated from Iowa State University in 1938 with a B.S. degree in forestry and received his M.S. degree there in 1939. He started his research career with the U. S. Forest Service at the Central States Experiment Station at Columbus, Ohio, on reforestation of spoil banks. During World War II he worked on the Timber Production War Project. In 1944, he went to the Northeastern Forest Experiment Station to work on silviculture control of the spruce budworm.

1955 Timber Utilization Reported by Interior

Timber harvested during the calendar year 1955 on lands administered by the Department of the Interior amounted to 1,486,689 M bd. ft., a slight increase over the previous year's cut of 1,474,088 M ft. The harvest was considerably higher on Indian lands but lower on Bureau of Land Management lands.

The average value per thousand board feet was $23.06 as contrasted to $17.69 for the previous year. This increase, an average of $5.37, reflects higher stumpage value. Ten years ago, in 1945, there was harvested from Department-managed lands 1,042,451 M bd. ft. valued at $4,231,751, or an average value per thousand board feet of $4.05.

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Oregon Makes New Bark Extraction Process Available to Industry

The Kurth bark extraction process which will provide the basis for a new industry in the Pacific Northwest will shortly be available for licensing, according to an announcement by the Oregon State Board of Forestry. The process developed by Dr. E. F. Kurth at the Oregon Forest Products Laboratory, and covered by state-owned patents, is designed to extract such products as waxes, tannins, and fine chemicals from the barks of native timber trees.

The M. W. Kellogg Company of New York City until recently held an option to license the process for wax production. Although this company has decided against commercial production of bark wax the information developed in the course of its investigations will be helpful to others who may consider the production of a variety of bark products. Consequently the Board of Forestry is soliciting inquiries from firms that are genuinely interested in reviewing available information on the bark extraction process with a view to possible licensing. Interested firms should write to the Oregon Forest Products Laboratory, Corvallis, Ore.

V. E. Hicks Promoted

Promotion of Vernon E. Hicks from assistant chief to chief of the section of Timber Inventories and Management Plans in the Timber Management Division of the Regional Headquarters of the U. S. Forest Service at Portland, Ore., has been announced by Regional Forester J. Herbert Stone. He replaces Howard Cook who was recently promoted to a forest supervisor position in the North Central Region. Hicks has been in the regional forester's office for the past five and one-half years. He is a 1932 graduate of the University of Michigan with a bachelor's degree in forestry.

Forest Service Personnel Changes, Promotions Announced

Kenneth A. Keeney, supervisor of the Coconino National Forest at Flagstaff, Ariz., has been appointed to head the Division of Information and Education in the U. S. Forest Service Northern Region. He succeeded James K. Vessey who was transferred to the North Central Region to head up State and Private Cooperation.

Ralph W. Crawford, for the past 17 years supervisor of the Deschutes National Forest, Bend, Ore., was transferred to Flagstaff to become supervisor of the Coconino.

James A. Egan has been promoted from the staff of the Southwest Region at Albuquerque, N. Mex. to supervisor of the Deschutes. Egan was first appointed to the Forest Service in 1935 after receiving his degree in forestry from the University of California. He later acquired a master's degree from the State University of New York College of Forestry and in 1942 a master's in public administration from American University. Egan has held various land management and administrative assignments with the Service, largely in the Southwest and was a Lieutenant (j.g.) in the Navy during World War II.

Research Foresters Sought

The U. S. Civil Service Commission has announced examinations for agricultural research scientists in two dozen fields, including forest products technology, general forestry research, and range conservation, in Grades GS-7 to GS-14 ($4,525 to $10,320). Applications may be secured from regional offices of the Civil Service Commission or from the Bureau of Departmental Operations, Civil Service Commission, Washington 25, D.C.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

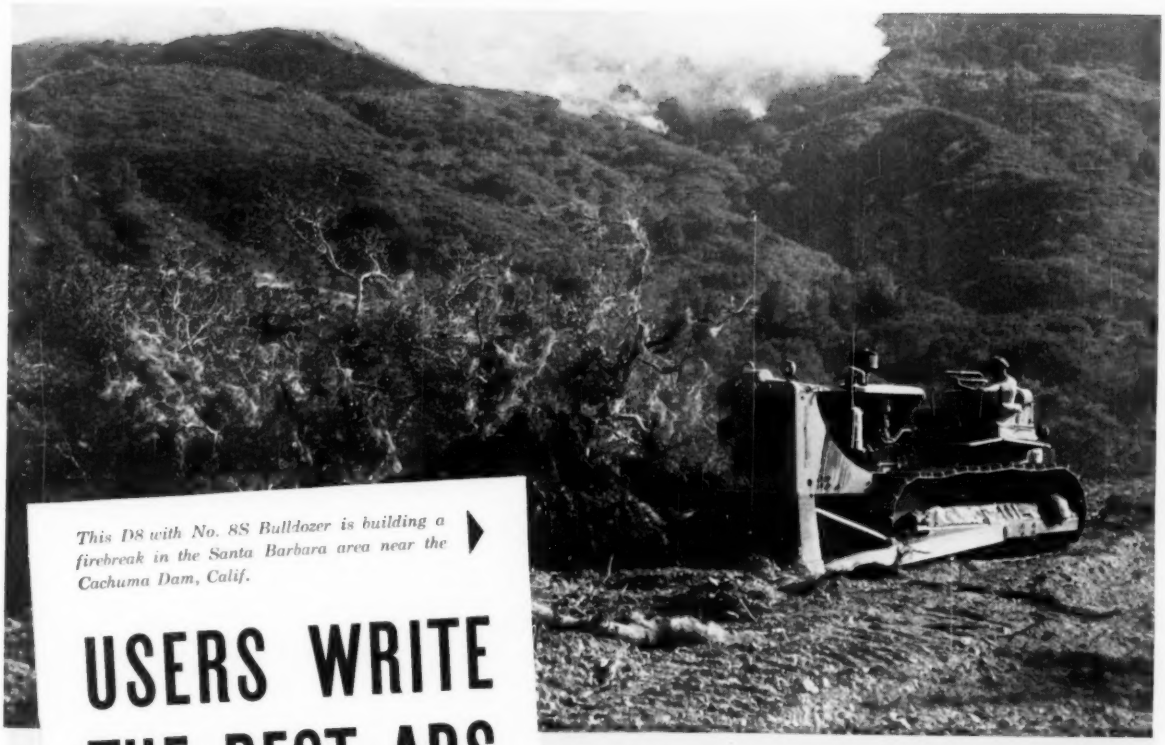
Positions Wanted

Forester, B.S., Univ. of Minn., 1939. Four years lbr. exp.; mfg., and retail. Three years forestry exp.; reforestation, timber sales, etc. Eight years military exp.—Reserve LCDR with administration designator. Two years social work—delinq. boys used in forest fire prevention. Single, thus in position to consider any locale or endeavor.

Box N, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, age 30; B.S.F., 1949. Married, veteran, 1 child; 7 years exp. Present position Pulpwood purchasing agent and repre. for large pulp and paper mill in east. Experienced in production and development in wood handling, supervision, plant engineering and maintenance, public relations, forest management, buying, selling, operating, road location and construction. Interested in young growing company.

Box O, Journal of Forestry, Mills Building, Washington 6, D. C.



This D8 with No. 8S Bulldozer is building a firebreak in the Santa Barbara area near the Cachuma Dam, Calif.

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That pretty much sums up the reasons why Caterpillar-built equipment has a reputation second to none. Of the other reasons, this is probably the most important: Year after year, Caterpillar continually engineers into its products improvements that keep them *ahead* of competition.

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And, because the Homelite EZ weighs only 19 pounds, it goes *anywhere* quickly and easily . . . lets you cut with less effort, less fatigue than any other chain saw!

Try this Floating Power of the new Homelite EZ . . . see how the all-position, all-angle carburetor lets you cut up, down, left, right — even upside down — with no adjustments, no loss of power. Ask your Homelite dealer for a free demonstration; find out, too, about the convenient time payment plan.

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